BASUTOLAND

DEPARTMENT OF AGRICULTURE

ANNUAL REPORT 1956

30 OCT 1961

BASUTOLAND

DEPARTMENT

OF

AGRICULTURE

ANNUAL REPORT

1956

MASERU

BASUTOLAND

MORIJA PRINTING WORKS
MORIJA - BASUTOLAND

CONTENTS

PART I

THE AGRICULTURAL INDUSTRY OF BASUTOLAND AND ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE

SECTION I	Review	1
SECTION II	Agriculture	5
SECTION III	Livestock Industry	10
SECTION IV	Veterinary	14
SECTION V	Soil Conservation	18
SECTION VI	Discussions with Paramount Chief	20
SECTION VII	Census and Social Survey	22

PART II

RESEARCH AND INVESTIGATION

SECTION I	Pilot Project	26
SECTION II	Mechanized Group Farming	32
SECTION III	Soil and Crop Research	32

PART I

THE AGRICULTURAL INDUSTRY OF BASUTOLAND AND ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE

SECTION I

REVIEW

1. THE TERRITORY

Basutoland is an enclave within the Union of South Africa, some 11,700 square miles in extent. Temperatures range from occasional periods when maxima rise above 90° F., to over 20° F. of frost in winter. Rainfall is variable, but averages about 29 inches yearly, mostly falling during the summer months. Growing seasons for the main crops are short, limited by the arrival of planting rains in the spring and the advent of the first frosts in April. The agricultural wealth of the Territory lies in exports of wool and mohair, and to a relatively minor degree wheat, sorghums and peas in that order.

The Territory is sharply divided into two, four fifths of it being steeply mountainous and practically without roads, reliance being placed almost entirely upon pack animals by the 200,000 inhabitants of these parts for transporting their produce and requirements. Compared with lowland areas, where soils are largely derived from sandstone, mountain soils are rich, production there depending upon rainfall and human effort. The larger proportion of the population lives however in the lowlands and foothills to the west of the Territory, where living conditions are not quite so difficult; but crop yields are poor on account of soils which are fundamentally lacking in plant nutrients, having been subjected to many decades of exploitation. Monoculture, lack of return of animal and crop wastes to the soil and soil erosion form the background to the crop production picture in the lowlands.

2. POLICY AND PROGRESS

Soil conservation in its widest sense, and an increase in production of foodstuffs and quality of livestock products remain the important features of departmental activities. Much of the purely mechanical side of soil

conservation work has been completed, as reference to page 18 will show, and more effort is now being directed towards an improvement in farming methods which will give permanency to anti-erosion works. For extension work reliance is placed on the field staff of 113 demonstrators. The regular annual outturn from the Agricultural School of young men trained in modern agricultural methods, most of whom will be absorbed into the Service, should go far towards improving the quality of this staff. (The first 16 students will be ready for posting in June 1957.) A Mosuto has been appointed Forestry Officer, and during the year considerable progress has been made in the establishment of nurseries for the growth of young trees, with the ultimate object of supplying firewood in place of animal manure which at present is practically the only fuel available for domestic use. A considerable increase in the use of D.D.T. as a control for maize stalk borer, one of the major limiting factors in production, is to be reported, and the value of phosphatic fertilizer, particularly in the northern districts, is becoming more generally recognized. The fact that crop yields are unsatisfactory has been recognized by the Basutoland Council, who have appointed a committee to report back on the subject. Soil and crop research, and investigations at Pilot Project and into mechanized farming possibilities continue.

Every year a considerable proportion of the maize and sorghum crops is damaged to a degree by frost before maturity, because of late planting of these crops. Field operations are almost exclusively powered by oxen, and much depends on the condition and available numbers of these for the timely execution of planting. In most lowland areas the balance between arable land and grassland (on which working oxen subsist) has been upset, and it seems that mechanization can supply an immediate answer to the problem of late planting. But in the meantime thought is being given to the wider problem of the proper integration of live stock and arable farming.

Concurrently with efforts to improve crop production and to introduce better farming methods have gone the usual importations of sheep and goat rams, a policy which has now been followed for twenty years and which has played a large part latterly in increasing the income of the Territory. Additional woolsheds for the communal use of flock owners have been constructed. A survey of mountain grazing areas is at present in progress as the first step towards implementing the Paramount Chief's Order which was published as Appendix IV to the 1955 Departmental Annual Report.

3. STAFF

Disposition of staff as at 31st December, 1956, is given in Appendix II to this Report.

In March Mr. L. H. Collett, O.B.E., Soil Conservation Officer and Mr. G. R. Chalmers, Wool and Mohair Officer, retired from the Service. Basutoland owes much of its recent development to both of them, for their twenty years of untiring service in their different spheres. Mr. Chalmers' work was recognized by his award of the M.B.E. in June. Mr. Youthed has taken over the work of organizing Soil Conservation, while

Mr. Bennie has returned from Mauritius and has been appointed as Wool and Mohair Officer.

Mr. E. Lesoli has been appointed Assistant Agricultural and Livestock Officer to the Maseru District.

Mr. Wuister took Mr. Naude's place as mechanic to the Pilot Project and Mechanized Group Farming Colonial Development and Welfare Schemes.

Messrs. Macintosh and Schneider were appointed as Assistant Soil Conservation Officers.

Mr. G. Nchee, after a short period of training in nursery work in Swaziland, has taken the post of Forestry Officer.

The death of Mr. Laurence Wacher is recorded with regret. Mr. Wacher was appointed to the Basutoland Service in 1910, and apart from a break for military service in the 1914–18 war, spent the whole of his working life – entirely on his own until 1936 – in the service of Basutoland. He retired in 1945. His name will long be remembered, particularly by his very many Basuto friends.

4. WEATHER CONDITIONS

Rainfall figures for the Territory are given at Appendix I to this Report. Conditions for growth and maturation of summer crops were satisfactory, first frosts were late and yields fair. Winter wheat suffered from an exceptionally dry period from June to October, followed by unsatisfactory harvesting conditions.

The summer crops to be harvested in May-July 1957 are not promising. Planting was delayed by continuous rains during November, and virtual floods accompanied by low average temperatures during December, have not allowed normal growth in the main food crops.

5. VISITORS AND VISITS

Agricultural progress in Basutoland continues to arouse interest outside the Territory. Among the many visitors were Dr. Wicht, Professor Batson, Mr. A. G. Odell from Entebbe, Miss M. Anderson and Dr. Munoz of World Health Organization (who are conducting a nutritional survey in two areas of the Territory), Sir Christopher and Lady Chancellor, Dr. Pitchford of World Health Organization, Professor Galbraith of California University, Sir Gilbert Laithwaite, Mr. Silk, Mr. Marshall, Mr. Nye of Gold Coast University and His Excellency the High Commissioner.

Members of the staff of the Department made visits to neighbouring territories as follows :

Messrs. Mapham and Youthed to the Drakensberg Conservation area to study recording methods and apparatus there in use.

Mr. Douglas to the Land Tenure Conference at Arusha, and thereafter accompanied by Mr. Letebele and Chief Tsikoane to Barotseland and Southern Rhodesia.

Mr. Bowmaker to the Grassland Conference at Pretoria organized by S.A.R.C.C.U.S., and to various meetings of the Wheat and Maize Industry Control Boards in Pretoria.

Mr. Campbell, accompanied by Chief Patrick 'Mota and Mr. E. Lesoli, to Southern Rhodesia to study the operation there of the Master Farmers Scheme, and to Bloemfontein Show accompanying the Paramount Chief and advisers.

Messrs. Mapham and Brightmore to Southern Rhodesia to study the application of the S.R. Native Land Husbandry Act.

Mr. Bennie to meetings of the Wool Board and the Mohair Advisory Board at Pretoria and Port Elizabeth.

6. ACKNOWLEDGMENTS

The assistance which the Department has had from Advisory Committees, and the loyal service of all members of the staff are gratefully acknowledged.

P. A. BOWMAKER,

Director of Livestock and Agricultural Services.

CROP PRODUCTION, FOOD SUPPLIES AND AGRICULTURAL EDUCATION

1. EXPORTS AND IMPORTS OF FOODSTUFFS

Crop yields generally were fair to good. Below are given exports of Wheat, Peas and Beans and Sorghums for which permits were issued, together with exports of these commodities for the previous three years for comparison ; at Appendix III monthly imports of maize, with average imports for the last eight years for comparison. It will be noted that the fair 1956 maize harvest is reflected in the below-average imports during the latter half of the year. £35,919 was paid to the Union Government as a refund of Union consumers' subsidy in respect of the 132,484 bags of maize imported into Basutoland.

EXPORTS OF FOODSTUFFS

(In bags of 200 lb. nett)

	1953	*1954*	*1955*	*1956*
Wheat	38,629	54,478	27,575	82,114
Peas and Beans	25,967	54,160	39,677	62,943
Sorghums and Malt	57,951	17,371	10,168	5,645

2. MAIZE AND SORGHUMS

Maize and sorghums form the staple foodstuffs of the Basuto people, some 70 per cent of the arable area of the lowlands being regularly given to these crops. Crops of maize were generally fair to good, largely on account of the late arrival of the first frosts, and satisfactory conditions for early growth. The standing maize crop shows very little promise, on account of late planting, very heavy rains in December (with which were associated temperatures too low for satisfactory growth) and a growth of weeds which it was not generally possible to control. Much land has been waterlogged, and there is evidence everywhere of "yellowing", a condition which has not yet been satisfactorily explained. Many lands were replanted (accentuating the general lateness of the crop) on account of attacks by maize beetle and cutworm, and the poor physical condition of lowland soils.

Exports of sorghums were much lower than usual. Stands generally were indifferent, as much of the seed used had been partially frosted before maturity and failed to germinate. Sorghum is usually the earliest spring crop to be sown, and the lateness of planting rains has resulted in fewer lands being sown to this crop than usual. A good 1957 crop is not anticipated.

One of the controlling factors in maize yields is the incidence of maize stalk-borer, which is general in earlier crops. The use of a D.D.T.

suspension for control is advocated departmentally ; the demand for supplies of this is now showing a substantial increase.

3. WHEAT

Wheat is sown as a winter crop in the lowlands, up to an altitude of about 6,000 feet, and in the spring for harvesting in February and March in the mountain zone. Crops better than average have resulted, although the lowland crop harvested in December was affected to a degree by the very dry winter and sprouting in stacks before threshing. Exports to the Union of South Africa were higher than for many years past, in excess of the imports of wheaten products by a very substantial margin.

Prospects for a good harvest in the mountains, where wheat is more generally grown than in the lowlands, are fair.

Interest in winter wheat in the northern districts, where in the past it has not been great, is increasing annually, a movement which is considered to be satisfactory.

4. OTHER CROPS

Peas, beans, oats and barley are minor crops, covering less than 10 per cent of the arable acreage. From the economic viewpoint peas are of significant importance, as a cash crop bringing in an income to the Territory (in 1956) of more than £150,000. With the exception of beans, of which the seed is mixed with maize at planting time, minor crops are mainly grown in the foothill and mountain areas.

5. TREE PLANTING

The necessity for providing a source of fuel as an alternative to animal manure continues to receive attention. During the year an African Forestry Officer was appointed after having had a short training in nursery technique in Swaziland. A note on his work is contained in the Soil Conservation Officer's report. Progress, and the fresh approach which can now be made to the Basuto Authority is considered to be satisfactory.

6. CO-OPERATIVE SOCIETIES

(A note supplied by the Registrar of Co-operative Societies)

Co-operative development is in the hands of the Registrar of Co-operative Societies, and his staff of one Assistant Registrar and Examiner of Accounts, and six African Inspectors. The registration and operation of Co-operative Societies are governed by specific legislation (Proclamation No. 47 of 1948 and High Commissioner's Notice No. 174 of 1948 as amended.)

At the end of 1956 there were 45 registered societies, of which twenty-three were engaged in produce marketing and the distribution of agricul-

tural equipment supplies and eleven were mechanized farming co-operatives. Others were of no direct agricultural interest.

The trading and marketing co-operatives receive no assistance from Government beyond the advice, audit and propaganda provided by the Registrar and his staff. Apart from a loan of £1,000 provided by Government to finance advances (against produce in transit) to co-operative society members exporting wool and mohair, these societies have no external source of credit or finance. They depend entirely on their own resources. They operate in open competition with the general dealers, through whom the bulk of the territory's agricultural produce is marketed. There is no agricultural credit organization. In these circumstances and under the conditions imposed by a subsistence agriculture, the accumulation of capital by co-operatives is slow and difficult, and lack of physical equipment and working capital prohibits – or seriously impedes – expansion.

The mechanized farming co-operatives are financed from Colonial Development and Welfare funds. They are experimental to a considerable extent and operate under the supervision of the Agricultural Department. Their activities are described elsewhere in this report.

During the nine months ending on June 30th, 1956, co-operative societies marketed 317,000 lb. wool, 8,500 lb. mohair and 19,000 lb. of hides and skins. Two societies exported a total of 94 head of cattle, of a gross value of £2,005. Several mechanized farming co-operatives experimented with the bulk sale of members' produce. Marketing and Farmers' Societies have supplied their members with agricultural implements, maize, sorghum, fertilizers, stock-salt, seed and insecticides.

7. MASERU EXPERIMENT STATION AND SCHOOL OF AGRICULTURE

Good progress was made during the year in the development of the Experiment Station and Agricultural School, both in the field of capital works and in the introduction of new research projects and an improved system of training.

Capital development dominated activities during the year and all station activities were affected by attention necessarily devoted to this work.

(1) *Research*

The research scheme consists of a programme of field experimentation into problems of soil fertility and includes a search for optimum varieties in relation to ecological regions. The work is carried out on the central station and on a set of 10 small district sub-stations scattered through the Territory, and on farmers' holdings. A certain amount of research in Swaziland is directed from the Maseru station.

In Part II Section III of this report are given detailed results of 1955–6 season investigations in Basutoland. Below is a summary of more important findings.

The deficiency of phosphate in lowland and foothill soils dominates the soil status picture. Responses to added phosphates have been shown

to be large in all crops in all areas of these regions and the conclusion is drawn that the general annual use of relatively small quantities of phosphatic fertilizer (or of manure or manure ash) by farmers could make the territory more than self-sufficient in food production. In the first season of such a general application an increase in maize production of at least 47 per cent would be brought about, or in terms of an annual maize acreage in these zones of 367,000, an increase in territorial food supplies of 580,000 bags of grain.

Rock phosphates, after the second successive year of application, are better than superphosphate for maize in the lowlands.

The soils of Basutoland still contain adequate supplies of available potash.

No final conclusions can as yet be drawn on the question of nitrogen manuring of cereals. Few responses to nitrogenous fertilizers have been recorded and the question is receiving increased attention.

Liming has been shown to be profitable in acid red ferruginous soils while on the common grey-brown sandy loams of the lowlands liming does not improve yields and may be dangerous through the induction of trace element deficiencies.

Kraal manure has large direct beneficial effects and substantial residual effects on crop yields. Manure in the phosphate deficient Basutoland lowlands has, however, a relatively low content of phosphate (0·015 - 0·020 per cent P) and large dressings need to be applied.

No trace element deficiencies have been discovered and dry soil and foliar spray applications of various trace element salts have not precluded the occurrence of "yeliowing" in maize in two cool wet seasons.

Further information has been accumulated on the performance of various crop varieties in the three ecological regions.

(2) *Education*

(i) *Agricultural School:* Steady progress has been made in developing the training at the Agricultural School along sound lines.

At the beginning of the year the second intake of 20 young men started their studies at the school, bringing the total roll for the 2¼ year diploma course to 36.

The students are trained in general agriculture, the course of training being aligned with the pattern of agriculture in the Territory. Major subjects are thus Crop Production, Animal Husbandry, Wool and Mohair and Soil Conservation. Practical training is obtained on the various station sections, on four small agricultural units run on differing farming systems by the students themselves, and in the field, where parties of students work on tree planting, dam construction, wool classing etc.

In the light of experience certain modifications were made in the organization of training. Entrants will in future spend three months working in the field under Departmental staff before commencing their studies at the school. The training year has been reorganized to follow more closely the agricultural calendar and an additional teacher has been recruited. Application has been made for further funds to provide additional facilities for the school.

The first graduates leave the school in May 1957.

(ii) *Vacation courses:* An important subsidiary activity of the school is the holding of short training or refresher courses for departmental

staff, chiefs and headmen and school teachers during the school vacations.

During the year two courses were organized :

(a) A course for 35 secondary school teachers on conservation and methods of teaching agriculture.

(b) A short course for 16 demonstrators on field experiment techniques.

(iii) *Agricultural Journal:* The publication of a bi-annual Agricultural Journal has met with a very good response. Approximately 6,000 copies are regularly sold. The scheme is self supporting, the selling price of the Journal bringing in a little more than the printing cost.

(3) *The Farm*

(i) *Development Work:* Good progress was made on capital development, the following works being completed : Five rondavels, two pig sties, an implement shed, a large composite building for the indoor work connected with field experiments, a sheep shearing and wool classing shed, a cattle kraal, two small milking byres, a football field, 2 dams, 6 water troughs, 3 miles of internal fencing, drains, water reticulations, etc. Development continues.

(ii) *Pigs and Poultry:* The production and distribution of pigs and poultry continued satisfactorily, 3,038 three month old birds and 104 weaner pigs being sold. The demand for stock continued to exceed the available supply.

(iii) *Tree Nursery:* 7,500 young deciduous trees and 17,000 boxed evergreen transplants were produced for issue to the soil conservation division and to farmers.

(iv) *Seeds and Fertilizers:* 100 tons of superphosphate, purchased under an advance account, were sold to farmers. The small fertilizer sale scheme is operated on a "pump priming" basis and it is hoped that now that a considerable demand for fertilizers has been built up in the Territory the trade will take over distribution of fertilizers. As it is, the quantity sold by Government was supplemented by many tons sold by traders, co-operative societies and farmers' associations.

A quantity of vegetable seeds was purchased in bulk and made up into small packets, of which 60,000 were sold to householders.

(v) *Irrigation Scheme:* Further information on the comparative merits of overhead spray and flood irrigation for lucerne was accumulated from the 25 acre irrigation project. Using a 24 H.P. tractor and with an initial delivery head of 50 feet from the river to the top of the bank, and hence the necessity to carry out two pumpings for the spray irrigation, flood irrigation is found to be more economical on this project.

(vi) *Agriculture and Horticulture:* Satisfactory progress has been made in the development of stable arable and grazing rotation systems for the farm, and production from the school vegetable garden has been increased.

8. GRAZING CONTROL

Fair progress has been made with the delimitation of the lower boundaries of the cattle post area and with the assessment of grazing potential and stock carrying capacity in the mountain area, the necessary preliminary to the full implementation of Paramount Chief's Order No. 1 of 1955 which was published in the 1955 Annual Report.

In the meantime steady progress is also being made with the introduction of a simple system of controlled grazing in village areas, particularly in the Phamong Ward. In some cases progress has been hampered by the wilful destruction of winter grazing by burning.

The correct usage of mountain grazing is shortly to form the subject of accurate investigation, and the Paramount Chief is being approached regarding the use of land for this purpose.

SECTION III

LIVESTOCK INDUSTRY

1. ECONOMIC ASPECT

This year has been a good one. Excellent and sustained rains during summer and early autumn ensured a sufficiency of grass and all livestock wintered well. Although the spring rains did not arrive until mid-October grazing is in excellent condit on and livestock, except in isolated pockets, are in very good condition. Ploughing has not been delayed this year to quite the same extent as usual as oxen were in condition to start immediately after the rains, but prospects for increased maize crops have been spoiled by heavy December rainfall accompanied by temperatures lower than usual.

2. LIVESTOCK AUCTION SALES

A further attempt was made to re-establish auction sales in Basutoland, and sales were held during the months of April and May at Leribe, Maseru and Mafeteng. Although the sales were conducted by a long established and well known auctioneering firm they failed to attract sufficient buyers to ensure healthy competition and fair prices. At the Leribe and Maseru sales the only two buyers present were also the biggest sellers. The introduction of one channel marketing, under which

system all persons exporting stock during a certain period are required to do so through these sales, resulted in large numbers of stock being produced, but with the exception of a number of outside buyers at the first Mafeteng sale, no buyers attended with the result that very few cattle were sold. The first Mafeteng sale was a success but the second which clashed with the Wepener monthly sale, was a failure.

Auction sales at Qacha's Nek, where there is a complete absence of speculators and the traders and local stock owners market their cattle at the stock sales, were successful and in all some 1,005 cattle and 1,142 sheep were sold during the year.

Imports of cattle slightly exceeded exports and the trading position remains healthy.

3. SHEEP AND WOOL

(1) *General*

Copious rains in the early part of the year resulted in a light, clean late-summer clip.

The undesirable type of ram is still impairing the quality of Basutoland wool.

(2) *Preparation of the Clip*

The get-up of the clip was satisfactory, wool inspectors, brokers and buyers at the Coast agreeing that it met with requirements. A complaint was received from a Belgian firm of manufacturers regarding foreign fibres in the wool, mainly horse-hair cords and string used by producers to fasten bags of wool. The few complaints received from Union Government wool inspectors at the coast dealt mainly with quite usual and understandable mistakes on the part of the wool classers at trading stations.

(3) *Wool Classing Courses*

Short refresher courses for qualified wool classers were held in all the districts, as well as longer courses for trainees. Most of them were well attended.

(4) *Wool Shed Construction*

Heavy rains in the early part of the year and a hard winter delayed the transportation of material into the mountains, and further delays were caused by the unreliability of the building contractor. A further six sheds were erected, bringing the total to 95.

(5) *Introduction of Merino Rams*

305 more merino rams were introduced, all of which were readily disposed of to flock owners, as well as a carry-over of 259 from the previous year.

Due to a sudden and unexpected late demand on the part of flock-owners a further 100 rams could have been sold. Further supplies, however, were unobtainable at such short notice.

A total of 14,400 rams has been introduced into the Territory since the inception of the Scheme in 1935. These have improved the quality of the Basutoland clip almost beyond recognition.

(6) *Wool Exports and Sales*

Duty was paid on 7,292,626 lb. of wool exported during the year. This was sold at an overall weighted average price of 33·72*d.* per lb. at the coast; 3·52*d.* per lb. or 11·66 per cent higher than last year. This realized £1,024,614, being £55,609 more than the gross sales in 1955.

These export figures do not take into account the unknown quantity of wool exported to the Union, without payment of tax, smuggling from an enclave Territory being a relatively easy matter.

Wool exported legally during the year shows a decrease of 408,075 lb. or 5·3 per cent on the 1955 figure. This may be accounted for to some extent by the comparative lightness of the late summer clip mentioned under "General" above, but on the other hand it is not improbable that an increased percentage of the clip was smuggled out of the Territory.

The average price per lb. of Basuto wool rose from 28·94*d.* in January to 38·63*d.* in December, on a practically continuous upward trend. This constituted a total increase of 33·5 per cent.

The prices throughout the year reflected good general competition on the part of the buyers.

The outlook for 1957 is promising.

4. ANGORA GOATS AND MOHAIR

(1) *Mohair Clip*

In spite of the continued introduction of good rams from the Union, there can be no appreciable improvement in the quality of the clip until all the undesirable rams are eliminated.

In the meanwhile the classing and packing regulations introduced in 1953 are proving a great step towards the uniformity of classing, hitherto so lacking in the Basutoland clip.

(2) *Importation of Rams*

206 Angora rams were introduced during the year, all of which were sold together with a carry-over from last year. This brings the total importations up to 1,644 since the first purchases in 1951. At least 250 will be required to meet the demand in 1957.

It is proving somewhat difficult to obtain rams of the right type at an economical price, but further sources of supply are being sought.

(3) *Mohair Classing Courses*

Short refresher courses were held for qualified mohair classers in all districts, as well as longer courses for trainees. Most of them were well attended.

(4) *Mohair Exports and Sales*

1,068,082 lb. of mohair were exported legally during the year and sold at the coast at an overall weighted average price of 76·66*d.* per lb., an

increase of 6·46*d.* per lb. or 9·2 per cent over last year. This realized £341,163 at the coast – £18,536 more than last year.

As in the case of wool, this export figure cannot take into account mohair smuggled over the border into the Union.

The weight of mohair on which export duty was paid during 1956 was 34,918 lb. or 3·17 per cent less than in the previous year.

During the opening months of the season, April to July, prices remained firm at an average of 80*d.* per lb. dropping steadily to 67·30*d.* in November. This was not unexpected, being regarded rather as a re-adjustment to true values than as a recession, Prices rose again to an average of 75·08*d.* in December.

There is a steady demand and an expanding market for mohair and the outlook is favourable for Basutoland, particularly if the quality of the clip is improved.

Throughout the year, length played a big part in determining the values of Basuto mohair, the keenest demand being for the longer lines.

Vegetable stain and it is regretted, too often faulty classing, caused considerable monetary loss to the industry.

5. HIDES AND SKINS

No improvement in the quality of hides produced can be reported. During the year Basutoland exported 25,914 hides and 117,474 skins.

6. TATTOOING AND REGISTRATION

The tattooing and registration of livestock continues steadily. There are still a number of faults which are being corrected and it is hoped with the appointment of more highly skilled and better paid personnel to supervise tank area work that these faults will disappear and the registers be brought up to date.

7. EQUINE IMPROVEMENT

The Agnes Mary Young Memorial Stud made steady progress during the year. It was found necessary to destroy two mares who, due to old age, were unable to come through the winter, and to return two others, which have proved sterile, to their owners. The stud now consists of Silver Eagle and twenty-one mares, while a further seven "agreement" mares have been served on the "first progeny to Government, second to owner" system. The stallion unfortunately suffered a severe contusion of the testicles half-way through the 1955–56 breeding season, which possibly accounts for the fact that eight mares served towards the end of summer have failed to conceive. To date ten foals have been born and a further four are expected.

The 1954–55 progeny have now reached the age of two years and it has been possible to form an opinion as to their quality. The standard is very pleasing, and with the exception of one colt which owing to persistent diarrhoea has failed to develop satisfactorily, all the colts have been approved and are being placed at stud throughout Basutoland. Some are standing at Government studs, whereas others have been placed under

the care of responsible stock-owners – usually chiefs – who will maintain them for use by the people of their areas. A further 5–7 colts should be available for issue annually in future. The fillies, which are equally promising, now number twenty and will form the foundation of the permanent stud which it is hoped to form shortly.

8. CATTLE IMPROVEMENT

Three additional Brown Swiss bulls were issued during the year under review, and some 28 bulls are now at stud. It is not easy, due to the difficult terrain, to follow up the progeny of these bulls, but an attempt has been made to assess the value of certain calves in the Pilot Project area. The general standard of the calves is fair, but no assessment of the real value of the Brown Swiss breed can be made until the heifer calves themselves reach the breeding stage.

P. H. Brown,
Principal Veterinary Officer.

J. G. S. Bennie,
Wool and Mohair Officer.

SECTION IV

VETERINARY

1. ANIMAL HEALTH

The year was a quiet one from the disease angle. With the exception of Lumpy Skin Disease in Maseru and vicinity there were no outbreaks of any of the major diseases.

2. SMEAR EXAMINATIONS

121 smears were examined microscopically during the year with the following results :

Anthrax	4
Quarter Evil	2
Anaplasmosis	2
Piroplasmosis (Bovine)	1
Piroplasmosis (Equine)	1
Piroplasmosis (Canine)	10
Negative	99
Unsuitable	2
	121

3. SCHEDULED DISEASES

(1) *Anthrax*

There were three outbreaks in Maseru and one in the Mohale's Hoek district. As usual a single animal was involved in each case and with the expeditious use of vaccine the outbreaks were quickly brought under control. Some 32,455 doses of Anthrax vaccine were used, the bulk of this being employed for the block inoculation of cattle in the south-western section of the Maseru district. No incidence among humans was reported.

(2) *Quarter Evil*

In all some 97 outbreaks were reported during the year, the distribution being as follows :

Maseru	18
Mafeteng	5
Mohale's Hoek	7
Quthing	28
Mokhotlong	20
Butha Buthe	19
	97

The stock owners in the most commonly affected areas are aware of the danger and make use of the vaccine, so losses are not usually severe. In all, some 21,630 doses of vaccine were issued.

(3) *Equine Mange*

Incidence has decreased but is still widespread throughout Basutoland.

(4) *Mange in other Livestock*

Not reported.

(5) *Lumpy Skin Disease*

This disease appeared in Maseru at the end of last year, and in the early months of this year reached epizootic proportions in the region of Maseru. Several deaths were recorded due to internal lesions, but the treatment with penicillin and the other antibiotics seemed to have a beneficial effect. The outbreak died down after the first frost, but made its appearance again on the Maseru reserve at the end of December, 1956. The position is being closely watched and should there be a flare-up recourse may be had to vaccination.

(6) *Rabies*

One suspected case of rabies occurred during the year in the Mafeteng district. This was not reported to the Veterinary Division at the time so no immediate investigation could be carried out. Onderstepoort reported that histological examination was negative, but no specimens were available for biological examination.

(7) *Other Scheduled Diseases*

Rinderpest, Foot and Mouth and East Coast Fever do not at present occur in Basutoland.

4. NON-SCHEDULED DISEASES

(1) *Anaplasmosis and Piroplasmosis*

Several cases of gallsickness and redwater occurred during the year but losses were not of any marked significance. Limited amounts of gallsickness vaccine were used, and in all some 58 doses of vaccine were issued. Owing to the distances involved the use of the redwater vaccine is not feasible.

(2) *Strangles*

There were the usual outbreaks of strangles. Treatment has proved effective and again no deaths were recorded.

(3) *Biliary*

Biliary in dogs has been very severe during the year under review and several dogs have died from the peracute form which has failed to respond to any form of medication. These animals show intense jaundice within a few hours of being discovered to be off-colour and usually die within 24–48 hours. There have been few cases in horses, most of which have responded to treatment.

(4) *Tetanus*

One case of tetanus was seen on the Maseru reserve, this case terminating fatally.

(5) *Verminosis*

The campaign against internal parasites in small stock has been intensified and definite progress can be recorded. This has been given high priority and all Veterinary Assistants are concentrating on this side of their duties. While progress has not been spectacular there are signs that the stock owners are beginning to realize the value of regular dosing, and in place of active opposition or apathy we are now encountering a more helpful and co-operative attitude in certain areas.

(6) *Poisoning*

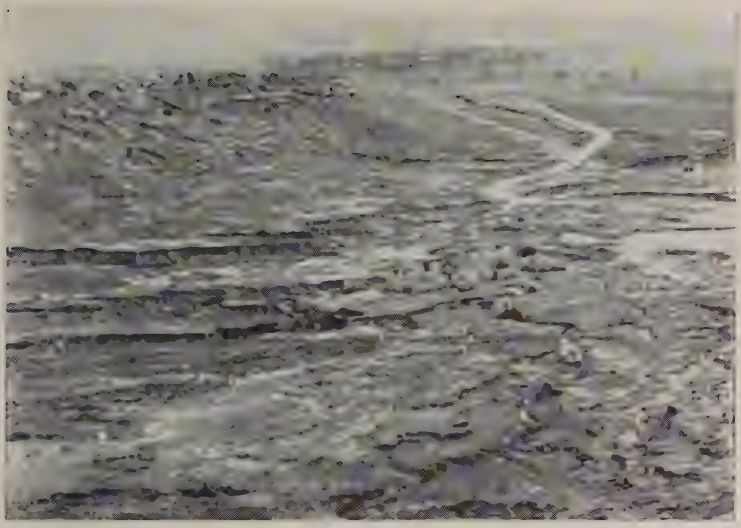
There were the usual deaths from grass-staggers this year but owing to the good rains and consequent fair grass cover the incidence was not as heavy as in former years. No losses from other forms of vegetable poisoning or from mineral poisoning were recorded.

(7) *Horsesickness*

Very few losses from this disease were recorded during the year.

(8) *Bluetongue*

Only minor losses from this disease were reported.



A denuded slope.

The same slope a few years later.

Before treatment.

After treatment.

(9) *Enterotoxaemia*

Has not been diagnosed in Basutoland.

(10) *Distemper*

Very few cases were seen.

(11) *Feline Enteritis*

No cases were seen.

(12) *Infectious Infertility*

Several cases of contagious abortion have been diagnosed. There is as yet no evidence that epivaginitis, which was rife in neighbouring areas of the Union, has spread to Basutoland, but it is doubtful if any such infection would be observed or reported by cattle owners.

(13) *Poultry Diseases*

(i) *Fowl Typhoid:* Several camps have reported losses from this disease, notably Butha Buthe and Morija. Outbreaks have been controlled by expeditious use of vaccine, 7,780 doses of which have been issued.

(ii) *Fowl Pox:* Very few cases have been reported. 7,350 doses of vaccine were issued during the year.

(iii) *Coccidiosis:* An outbreak in the poultry plant at the Maseru Experimental Farm caused some losses, but the outbreak was controlled by medication.

(iv) *Other Diseases* were not recorded during the year.

5. GENERAL

The Veterinary Division was brought up to full strength by the appointment of Mr. N. N. Raditapole as Veterinary Officer in February 1956.

The clinic has as usual been kept busy treating the sick and the lame, and in all some 2,500 cases were handled during the year. Revenue amounted to £600. With the appointment of a Veterinary Officer it has proved possible to keep in closer contact with district staffs and people in more remote areas. The district Veterinary Assistants concentrate more on disease control work, but a certain amount of clinical work is undertaken. Veterinary fees collected by districts amounted to £560.

P. H. Brown,

Principal Veterinary Officer.

SECTION V

SOIL CONSERVATION

1. SUMMARY

The scheme is primarily concerned with anti-erosion measures in the form of contours, dams, tree planting, fencing, as the initial step towards soil stabilization. This, the preliminary stage, is rapidly drawing to a close, and it is estimated that finality should be reached in two to three years – there being virtually only one major catchment left in the Mafeteng district as yet untouched as far as anti-erosion measures are concerned. Buffer stripping in the mountain areas is practically finished – only localized "mopping up" operations being left to be seen to.

There are nine tractor gangs operating in the Lowlands; next year these will be reduced to six or seven as gangs complete areas and equipment is switched to reinforce other gangs still in operation. These gangs are under the direct supervision of two Senior Conservation Foremen one in the north and one in the south – who are directly responsible to the Assistant Soil Conservation Officer for work in their regions.

2. PROGRESS

The progress made during the year in the principal sections of the work is summarised below:

Measure	*Prior to 1956*	*During the year*	*Totals to December 1956*
Area terraced Lowlands (acres)	430,548	19,356	449,904
Length of Terraces (miles)	24,598	970	25,568
Buffer Strips (acres)	670,941	15,337	686,278
Diversion Furrows (miles)	3,935	15	3,950
Dams Constructed	482	30	512
Trees Planted	1,012,552	75,124	1,087,676
Dongas Beaconed (miles)	5,345	23	5,368

(1) *Buffer Stripping*

At a cost of £432 15*s*. 8*d*., 15,337 acres were covered with 2,621,241 yards of buffer strips this season. This is considered to be most satisfactory progress, particularly as in some districts work was completed before the end of the season. The system of having the strips marked by the farmers themselves has largely been responsible for increased output. As has already been stated this aspect of the work is virtually completed and all that remains is to ensure that work done is properly maintained.

(2) *Terraces*

£16,018 was spent on laying out terraces in 19,356 acres of lowlands involving over 1,706,000 yards of completed terrace. This works out at less than £1 per acre which is considered to be satisfactory. Frequent breakdown of outdated tractor models has held up work appreciably, and has involved the scheme in heavy expenditure on repairs. However, it is hoped that as gangs are reduced worn out machines will be replaced by the new models purchased this year.

(3) *Diversion Furrows*

This aspect of the work has tailed off during the last two years as it is thought that further diversion furrows should not be constructed until proper disposal facilities, in the form of meadow strips, have been provided. However, 1,009 acres were protected by 15 miles of furrow costing £244.

(4) *Dam Construction*

30 dams with a total capacity of 36,023,000 gallons were constructed this year, at a cost of £2,811. This high content is related to construction of dams of larger size than usual across perennial streams. This is concerned with flood control and development of water resources.

It is anticipated that this production figure will be stepped up this year when all the new plant becomes fully employed. Due to the late arrival of new plant the improved facilities could not be fully employed.

(5) *Tree Planting*

The appointment of a Forestry Officer to the permanent establishment marks a big step forward in developing tree planting in the territory. Forestry has now virtually become an entity of its own and will be run under an independent organization but in closest contact with the soil conservation programme.

Central nurseries have been organized in eight districts, and the planting of seeds and cuttings in these nurseries is satisfactory. Full production will be achieved in about two years' time.

This year 75,124 trees, mostly suckering varieties of poplar, have been planted out in the field.

(6) *Grass Planting*

Grass planting was effected in dongas and on the banks of newly constructed dams at a cost of £326.

(7) *Meadow Stripping*

As districts completed buffer stripping, operations were switched to meadow stripping. This consists of closing arable land to cultivation in the vicinity of water courses or by the edges of streams. The object is to stabilise the main drainage lines in the mountains and to provide adequate disposal for diversion works laid out above arable land. So far 70,000 yards of meadow strips have been beaconed.

(8) *Donga Beaconing*

This work still continues but meets with varied success, depending largely on co-operation from individual land owners.

So far in this work a rule of thumb method – beaconing dongas to a width equal to their depth – has been used. It is felt that in many cases this is not sufficient, and areas in excess of this width have been demarcated where it is thought necessary. For example, in the case of meandering streams a system of parallel beaconing is used, by which means land projecting into stream bends is removed from cultivation. This year 23 miles of donga were beaconed at a cost of £105.

3. FINANCE

Capital funds have proved adequate and have been fully spent, new earth moving units having been purchased, including a complete D6 dozer and scraper unit and scrapers and dozers to fit to some of the newer model D4 tractors.

Three concrete mixers and one rock crusher were purchased. These units are not in full operation as yet. However, concrete construction operations have commenced in Leribe and sites for weirs have been selected in other districts.

It is now realized that the older model tractors, which it was hoped would see out the scheme, have reached the end of their useful life and are becoming a heavy burden on the repairs vote.

S. H. Youthed,
Soil Conservation Officer.

SECTION VI

DISCUSSIONS WITH PARAMOUNT CHIEF AND ADVISERS AND LIAISON WORK

Three years ago an Administrative Assistant was appointed to act as liaison officer between the Director and the Paramount Chief. His main function is to discuss matters of lesser departmental policy with the Paramount Chief and Advisers, and to assist District staff in the implementation of policy in certain wards where in the past this has been a matter of varying degrees of difficulty. It is considered that a good purpose will be served by the inclusion in this and future reports of decisions arrived at in some detail for permanent record.

The Administrative Assistant reports as follows :

During the year under review the Administrative Assistant was away on secondment to Census and Social Survey work. Later in the year when he returned to the Department, several meetings were arranged and held with the Paramount Chief and Advisers and Principal and Ward Chiefs in various districts on matters pertaining to agriculture.

Interviews were held with the Paramount Chief on the following more important matters :

(1) Reclamation work in the Taung Ward, one of the most eroded in Basutoland. Conservation work was started during the year and is now in full progress.

(2) The new tree planting scheme for which Mr. G. Nchee has been appointed Forestry Officer, and for which financial provision is made in Colonial Development and Welfare Scheme D. 2707.

(3) The demarcation of cattle-post country and assessment of the carrying capacity of all cattle-post areas in each district. Chiefs and people have been instructed to assist in this work by erecting beacons under the general direction of the Development Officer who is in overall charge of this work.

(4) Reorganization of the anti-erosion maintenance staff and grazing control caretakers with a view to getting more efficiency with a better type of worker.

During the year the Administrative Assistant accompanied Chief Patrick 'Mota, a representative of the Paramount Chief, to the following places : Thaba-Tšoeu in the Mafeteng District, where the Thaba-Tšoeu plateau was declared an improvement area with a grazing caretaker appointed ; Jobo Nthoana's, where a line was fixed to indicate the top line of cultivation ; Masemouse area, which was declared a resting area, with all livestock ordered to be removed and Chief Mpheulane Sechaba appointed as caretaker by the Paramount Chief. Qhobeng, Ketane and Maletsunyane controlled grazing areas were also visited.

The Administrative Assistant accompanied the Paramount Chief's Advisers to Teyateyaneng, where a dispute between Chieftainess Mamathe and Chief Makhabane over reserved grazing in the mountain areas was settled. Mokhotlong and Qacha's Nek Districts were visited by the Principal Agricultural Officer and Administrative Assistant on an extensive inspection tour of the grazing areas near the Natal and East Griqualand borders. Later they visited Mokhotlong with Paramount Chief's Representative Chief Patrick 'Mota, where a pitso was held at Sani Flats with District Commissioners and District Chiefs of Qacha's Nek and Mokhotlong to settle the Sani Flats controlled grazing plan which the Paramount Chief had ordered to safeguard this area. A line was defined within which all livestock were to be removed immediately. Chiefs, Theko Makhaola and Matlere Lerotholi were ordered by the Paramount Chief's Representative to exercise strict control over their people and to see that there is no further trespass in this area.

Chief Patrick 'Mota and the Administrative Assistant were also sent to Mohale's Hoek to interview Chief Nkhahle Phakiso and warn him against further opening up of virgin lands in the Ketane and Ketanyane vallies.

Certain misunderstandings were also settled in the Leribe District where Chief Patrick 'Mota and the Administrative Assistant were sent

in connection with certain members of the grazing control staff who were reported not to be doing their work properly.

Quthing was also visited by the Principal Agricultural Officer and the Administrative Assistant to settle a misunderstanding which had arisen between the District Chief and the Agricultural and Livestock Officer over the control of conservation maintenance staff. The misunderstanding was amicably settled and all parties concerned expressed their satisfaction with the conclusion arrived at.

NTSEKE J. MOLAPO,
Administrative Assistant.

SECTION VII

CENSUS AND SOCIAL SURVEY

A population census and the first part of a social survey were carried out in Basutoland during 1956. The Agricultural Department was closely connected with this project and provided office accommodation for the Administrative Officer and his small staff responsible for carrying out this work in the Territory. The African Administrative Assistant who is the Agricultural Department liaison officer was also seconded to help with the census and social survey for the greater part of the year. The social survey is being directed by Professor E. Batson of Cape Town University, who also advised on the planning of the census.

The object of the social survey is to provide properly co-ordinated information about the social and economic life of the Basuto people. Professor Batson has recommended that the survey be carried out in three parts. The special function of a broad survey such as he recommended is to multiply the significance of field data by correlating it fully. The information so discovered will be used to help plan future development policy in Basutoland. Part I of the survey was carried out in 1956. It is hoped that the technique for subsequent stages can be improved, by the experience gained as the work progresses.

The social survey was closely linked with the population census. A decennial census was due to be taken in Basutoland in 1956 and it was convenient to design the census in such a way that the data collected would provide an up-to-date frame for a social survey by random sampling methods. A simple total enumeration census was therefore planned to produce a limited amount of accurate demographic information. The enumeration was carried out by school teachers whose enumerators' areas corresponded to the 202 Agricultural Dip Tank areas. These areas were well known to the people and had been originally established by

the Agricultural Department during the campaign to eradicate sheep scab in the nineteen twenties. Prior to the census, Agricultural Officers and their staff assisted the Census and Social Survey Officer to check the boundaries of these areas and mark them accurately on the new 1 : 50,000 aerial survey maps. The dip tank areas had previously only been marked on the old, smaller scale Dobson map and some changes in these boundaries had occurred. Each dip tank area has a supervisor responsible for stock registration and other agricultural work. These men assisted the census enumerators in locating villages and finding the boundaries of their areas, these ranging in size from 10 to 141 square miles and averaging 58 square miles over the whole Territory.

The census enumeration plan was tested in a pilot census in one dip tank area in Maseru district. As a result of this work the census schedule was finally designed. It aimed to give an up to date list of households in each dip tank area, together with the numbers of dwellings, numbers of males and females present, males at the cattle posts who were not directly enumerated, numbers of absentees and adherents to the principal religions. This latter item was included as it was not practicable to collect such information by sampling technique in the social survey because of the large number of groups of persons giving allegiance to churches situated near their homes. The small non-African population was not to be enumerated by dip tank areas but mainly by postal questionnaires, as the social survey was not designed to include the non-African population.

A training course for a team of investigators and a pilot social survey was conducted by Professor Batson and a Field Research Officer from Cape Town University in January 1956. The pilot survey was carried out in the dip tank area used for the pilot census. The sampling procedure was tested using the list of households obtained in the pilot census and the final social survey schedules were designed as a result of field experience. The information required from the social survey had been discussed carefully with Heads of Departments. Consideration was given to these requirements and to the practical difficulties of collecting different classes of information in designing the final list of quaesita for Stage 1 of the survey. A large number of demographic items were included as the simple total enumeration census was only to give basic data. The following other questions about the living conditions of the people were also included : structure of dwellings, household artifacts, systems of saving money, water supplies, number of lands and how cultivated, crops harvested, crop storage facilities, share cropping of lands, agricultural transport, subsistence of old or infirm persons and incidence of blindness.

The biggest problem in carrying out a social survey by random sampling methods in a mountainous country like Basutoland, with difficult communications is to keep the time taken to collect information, and the cost, within reasonable limits. The sampling procedure was designed primarily to give data on a territorial basis. It is hoped however to give estimates for zones and regions of the Territory within fairly wide belts of possible sampling errors for certain classes of information. The final stratified random sample was of 34 dip tank areas, in each of which a random sample of sixty households was taken from the lists of households given by the census.

The census began in the second week of April 1956 after enumerators' training courses had been held at each district headquarters. District Commissioners and Agricultural Officers were gazetted as census officers for their districts. They organized the census work under the general direction of the Census and Social Survey Officer and his staff. The enumerators completed the population count within seven to ten days in each dip tank area, and brought their books of census schedules to district headquarters for checking. The social survey team consisting of twelve investigators moved up to the mountain district of Mokhotlong (with more than one ton of trekking equipment), and began work on April 19th in the first sample dip tank area. The Agricultural Department provided a large share of the camping equipment, animals and pack grooms. The team with about sixty transport animals proceeded to collect information, by individual visits to households, in the sample areas of Mokhotlong, Qacha's Nek and Quthing districts, under the control of the Census and Social Survey Officer and his seconded African Administrative Assistant. Three Education Department School Supervisors, included in the team, acted as survey section leaders. The main mountain itinerary was finished in the middle of June before the really cold winter weather began. Thereafter the work proceeded on the same pattern in the Lowland and Foothill areas, except that lorry transport was used wherever possible. Occasional short treks were made by the team to reach other mountain sample dip tank areas not included in the main mountain itinerary. The survey team completed its work at the end of September having collected information from about two thousand households. This provided data relating to more than ten thousand persons, including absentees. The investigators did a certain amount of pre-coding of the information which they collected on their field schedules. When the work was complete in each sample area, the Census and Social Survey Officer or his seconded African Administrative Assistant carried out field editing. The batch of schedules for the area was then dispatched direct to Cape Town University for final coding and tabulation. The collection of information in the field and tabulation was therefore being done simultaneously.

The population was advised generally about the work of the social survey team by Paramount Chief's circulars sent to all important chiefs. The census enumerators and Agricultural Departmental staff were instructed to tell the people about the coming of the survey team. Information notices were also circulated. The attitude of the respondents towards the investigators was usually one of initial suspicion. The investigators had however been trained to explain their work to the householders and to gain their confidence. There were thus ultimately very few cases of refusal to give information. In a number of cases, especially where the persons required were absentee workers, close relatives furnished the information. There was a complete nil return of information in only about 1 per cent of the household names sampled for investigation. This also indicated a good standard of work by the census enumerators in compiling accurate details about the households. The census reports from District Headquarters suggested that the census enumeration was reasonably complete throughout the Territory. It is therefore thought that the frame used for the social survey was a reliable one. Every possible

precaution was taken to avoid bias in the sampling procedure from the checking of sample dip tank area boundaries to the random selection of households from census enumerators' books. For the latter, the simple formula used proved quite workable in the field. Professor Batson has said he is very satisfied with the standard of investigation work, as seen from the tabulation of data so far carried out. Chiefs and government departmental field staff, especially those of the Agricultural Department, helped investigators to locate the households in the areas visited. A particular feature of the co-operation between the team of investigators and the local Basuto authority was the great assistance given by the junior headmen and village heads.

Preliminary census figures were available in September, 1956, and a full report of the Census will be published during 1957. The final social survey tabulation work is at present in progress under the supervision of Professor Batson. Hand sorted punched cards are being used for this work, and it is not yet possible to comment on the quality of the different classes of information collected. It is expected that the initial report on the social survey, which is being written by Professor Batson, will be available during the first half of 1957. This will be short, mainly setting out in tabular form the information collected in Stage I of the survey, together with an estimate of the margin of sampling error for each type of data. When these initial results are available, plans will be made for Stage II of the work.

In conclusion it should be mentioned that it is very appropriate that the social survey of Basutoland by random sampling methods should have been carried out in close collaboration with the Agricultural Department. This department was the first to use proper sampling methods in Basutoland for the 1949–50 Agricultural Survey.

D. H. Taylor,

Census and Social Survey Officer.

PART II

RESEARCH AND INVESTIGATION

SECTION I

PILOT PROJECT

Descriptions of work in progress given in previous annual reports on this scheme apply also to the year under review, save as augmented or amended in the present report.

1. RECLAMATION

(1) *Soil Conservation*

Works constructed from 1st April 1953 to 31st December 1956 :

Soil conservation bunds (mechanically constructed)	496,557 yds	4965 acres
Buffer (grass) strips (marked out using land owners' own oxen)	1,056,651 yds	4372 acres
Diversion furrows above cultivated land (by hand)	19,995 yds	799 acres

Construction of stone silt barriers in gullies and on denuded slopes, and planting of kikuyu grass and *Agave* have continued.

(2) *Dams*

There are now 17 dams with a capacity of about 8 million gallons. Many of these have silted up and are being planted to grass or reeds. The effect of soil conservation measures, including tree-planting in gullies, will be to slow down the rate of silting, but the basic problems (of which silting is an index) must be met by planned land use and efficient maintenance by chiefs and people of completed protective works.

(3) *Tree Planting*

Estimated number of trees planted since 1st April, 1953, and surviving at 31st December, 1956, are :

Deciduous	42,000.
Coniferous	1,700.

The figure for deciduous trees includes 38,700 poplars planted in gullies by local people under a "village grant" scheme which has proved successful.

There is a steady demand for trees from the nursery ; and some species of seedlings – particularly fruit trees – are now distributed to other parts of the territory.

(4) *Planting of Grass and Reeds*

This work continues slowly.

(5) *Grazing Control*

There have been no major developments since the last report but the areas under rotation have been extended. Although interest in the care of grazing is increasing, effective control continues to be hampered by constant boundary disputes between headmen, unauthorized burning, and inadequate supervision of herd boys.

(6) *Improved Land Use*

During the past year, Pilot Project staff and the representative of the Ward Chief toured the area and agreed on plans for taking out of cultivation many lands on steep slopes, and for moving villages whose situation prevents effective soil conservation and grazing control, to specially planned sites. The Ward Chief agreed to a substantial part of these recommendations, and issued orders accordingly. It remains to be seen how effectively the Basuto authorities will enforce and carry out these orders.

The village planning aspect is referred to under Community Development. In the badly eroded Thota-peli area all concerned have agreed to the closing of existing lands between gullies ; the opening of old lands elsewhere in suitable blocks well protected against erosion ; fencing for tree planting ; and additional dams.

2. DEMONSTRATION

(1) *Agricultural Extension Work*

It is difficult to assess the effects of the agricultural staff's touring, demonstrations etc. on the peasants' farming practice, especially as the past season was a good one. But they may fairly share the credit for the increasing use of kraal manure and fertilizers, planting of wheat, beans and peas, winter fallowing, purchase of carts and insecticides. The latter in particular are encouraging developments, which are also spreading in other parts of Basutoland.

(2) *Co-operative Experiments*

These have been continued. Statistical results for the past season are given in the Soil Fertility Officer's report. These trials serve a useful though limited purpose in demonstrating the value of manure and fertilizers to local farmers.

(3) *Carts*

48 carts have been sold through this scheme in the last year, bringing the total to 126. Of these, the greater number are "Zebra" carts from

Southern Rhodesia, a type which has proved better than any so far made in the Union. The recent imposition of a 25 per cent import duty and the high railage charges will severely reduce sales of this cart, and attempts are being made to get suitable carts made in nearby Union towns. A prototype designed to meet local needs is now under trial. Funds have again been inadequate to finance the scheme, because revenue accruing from sales is not permitted to be used to finance new purchases, which are therefore limited to the annual provision in the estimates. Government has not so far been able to make other arrangements.

(4) *Livestock Improvement*

The five Brown Swiss bulls are now as far as possible confined to "closed herds", under the control of selected local headmen. Each runs with a single herd, from which scrub bulls are excluded. This results in more cross-bred progeny than under the previous system whereby heifers had to be brought to the bull, which was over-jealously guarded by its custodian.

3. INVESTIGATION

(1) *Co-operative Mechanized Farming*

The third year of this experiment ended in June-July, 1956, with satisfactory harvests in the four mechanized groups, due partly to the good season, but partly also to timeliness in ploughing and planting, thanks to the tractors, and to greater care in weed and pest control by the members. The average yield in group lands was again substantially greater than in adjoining lands as the following figures show :

Maize yields

(in bags – 200 lb. – per acre)

Group	1954–55		1955–56	
	Group lands	Non-group lands	Group lands	Non-group lands
Mesapela.	2·21	1·75	5·62	2·12
Thaba Chitja. . . .	6·35	?	11·78	9·55
Rampepes	9·13	6·99	9·96	9·55
Malimong	4·23	2·03	8·91	3·98

These results and the improvement in the work of secretary-managers and drivers show that co-operative mechanized farming is capable of making a real contribution to Basutoland's economy. Unfortunately the majority of Basuto farmers, whilst ready enough to acknowledge the tractor's advantages and to demand its services, are slow to understand and accept the system which has been offered to them. Few grasp that the tractor must work large compact blocks if the cost per acre is to be kept to the minimum ; and there is little zeal or aptitude for co-operative management. These difficulties might however be overcome if most farmers could be induced to pay their charges for the next season in cash

or in kind at harvest time ; instead the majority wait until they are ready to plough, by which time most of the previous crop has been disposed of and cash is short. As a result few lands are paid for in good time ; many not at all ; and so one effect of insistence on pre-payment (which is now rigidly enforced) is to break the original blocks into scattered fragments, the cost per acre being raised correspondingly.

It is also clear that few members appreciate the advantages of planting and inter-row cultivation by tractor : the main demand is for ploughing only.

Re-allocation of land, by bringing the more progressive farmers together, would restore much of the efficiency and economy of the original groups, but unfortunately the chiefs, who are the land authorities, have shown no inclination to permit this, although it is not contrary to customary law. It has therefore become necessary to meet the situation to some extent by allowing individual ploughing and/or planting, thus making the tractor available to a larger number of the better farmers who hold lands apart from the original groups. The fees for individual fields are of course proportionately higher than in the groups : charges for ploughing alone vary from 30*s*. per acre for a field less than 3 acres to 15*s*. per acre for a block of 50 acres or more. The differential rates for ploughing and planting under this system are intended to secure maximum work for the tractor at approximately cost price and to encourage farmers with adjoining lands to combine. (It is hoped shortly to introduce further differentials, benefitting members as against non-members and encouraging early payment.)

This arrangement by and large meets the wishes of the local people but the resulting waste of time, fuel, etc. have greatly reduced the efficiency and raised the true cost of the tractor service. Not only is there considerably more unproductive travelling and idling by the tractor, but supervision is more difficult. The problem of late payment remains, and as a result the acreage ploughed was considerably less than it could have been. Even within the original blocks, individual hire-ploughing replaced group operations, at increased cost to the society and members. In several instances the secretaries were unable to resist pressure applied to them to reduce or waive cultivation charges (the chiefs being the worst offenders) but it is fair to add that the present season has seen a considerable improvement in this respect.

Indeed, the value of the present difficulties lies in the opportunity presented to committees and local farmers to learn, from their own experience, the basic principles and economics of this form of enterprise. There is little doubt that the demand for tractor services must increase, and the present experiment will show under what circumstances they are economic and feasible.

Tractor transport and ploughing for wheat are being encouraged and off-season work of this kind has greatly increased. The provision of tractors now permits the carriage of produce, timber, reeds, grass, manure, etc., and the demand for this service is growing. In all cases the secretaries organize this work themselves, with less assistance from Government staff than in previous years, and in general they have managed reasonably well.

In accordance with the policy originally laid down for these societies,

they now carry increased financial responsibility; this season's fuel and wages bills were paid by the secretaries entirely from the societies' funds. This evidence of progress however must not obscure the following facts:

(1) Owing to the large sum in arrear charges (for the first two years) uncollected, the societies are in arrears with annual credits to their Replacement of Machinery Accounts.
(2) Unless the tractor is fully and economically employed, the societies' revenue cannot continue to meet their expenditure.
(3) One danger of the tendency to break away from the original co-operative groups of lands to a looser organization, operating a form of hire service, is that eventually such bodies might be left without a permanent membership having a stake in the enterprise and a voice in its management. It is hoped to avoid this by continuing to insist on the principle of membership of a co-operative society, members paying an entrance subscription and getting preferential treatment, e.g. in priority of tractor work and in lower cultivation charges, as compared with non-members.

A useful training course (including drivers) and conference for committee members was held during the year, jointly with Scheme D. 2205.

Considerable data on tractor operations under the conditions to be found in Basutoland has been collected over the past three years and should be of great practical value. An analysis of costs is given in Appendix IV to this report.

(2) *Other Trials*

No irrigation has yet been carried out in the Khohlong area, where the problem is rather one of drainage. Initial trials with lucerne in this area have so far been disappointing, probably due to waterlogging, and drainage is to be further improved.

Black bass in the fish ponds have multiplied satisfactorily. Trial nettings will begin in 1957.

4. COMMUNITY DEVELOPMENT

The Tebetebeng Farmers' Co-operative Society, with 94 members, plays a small but potentially useful part in the life of the local community. Hitherto disappointingly unenterprising, it has shown signs of more vigour. Its ambition to buy and store maize for resale at reasonable prices when grain is scarce met with a discouraging response the first season, but this is a venture worth persevering with.

Local developments of the kind described in previous reports have continued on a small scale. There is increasing evidence of a will for improvement, all too often thwarted by the apathy or opposition of headmen and minor chiefs. The schools have continued to set an example in their small way, not least Mpara, which pioneered the planting of poplars in gullies, and Thana, which with a certain amount of help from Pilot Project sources, built an extension to the school which will also serve as church and community centre.

Dr. Munoz and Miss Anderson of the World Health Organization are engaged on a survey of nutrition and allied health problems, on a sample of households in the Tebetebeng valley.

Village planning has been referred to earlier in this report. It is necessary, in order to conserve soil and grazing, to move villages from unsuitable positions to well-placed sites – wherever possible the main village of the headman. To make these villages more attractive and healthy, new hut sites have been laid out on the contour, gardens marked out, conservation and irrigation furrows provided, tree plantations, orchards, school gardens etc. started. Where water supplies have not already been protected, funds are being made available for this purpose from district sources, by agreement with the District Council. There is a genuine demand for village planning, though it often loses its force when it comes to active help e.g. in fencing and tree planting.

5. PUBLICITY AND EXTENSION

During the year under review, more than 600 Basuto visited the scheme, bringing the total to over 1,000, the great majority in parties which came largely of their own initiative. Schools continued to provide the most indefatigable and keenly interested of our visitors. Correspondence and enquiries from other parts of Basutoland, and the interest aroused by photographs and other forms of publicity, show that the more energetic and enlightened Basuto throughout the territory are anxious for guidance and help, and that some are ready to make real efforts. Steps are now being taken to form an extension team which after an initial period in the Tebetebeng will work elsewhere, with the object of stimulating local development, mainly in the form of self-help : e.g. village water supplies, sanitation and tree planting.

6. OPERATION OF THE SCHEME

The political situation remains as before. The Pilot Project staff has been fortunate in retaining most of its members from the beginning of the scheme, and forms an efficient and well-knit team.

Better co-ordination of departmental activities and fuller participation in the Project by the Basuto administration and various departments, including education and medical, will be secured by means of the inter-departmental committee recently set up by the Resident Commissioner.

7. CONCLUSION

It is necessary now to look ahead to the official expiry of the scheme in 1960, which should not mean the end of the work presently in hand. It is imperative that before then there should be, at "local government" level, the machinery and the will to continue, maintain and extend what has been started. This will depend largely on progress made in administrative reforms for the territory as a whole.

A. J. A. Douglas,
District Officer in Charge.

SECTION II

MECHANIZED GROUP FARMING

(see also pages 28–30)

The objects of the scheme remain as stated in the original application for Colonial Development and Welfare assistance.

As was stated in the 1954–55 report, seven Group Farms have been established outside the Pilot Project area. Three have now completed two seasons, and four one.

The Group Committees are to a degree now organizing and running group affairs, ordering and paying for their fuel and fertilizer, paying their drivers and planning the work in the field, under the general direction of the Agricultural and Livestock Officer in charge.

It is now clear that collection of charges is the biggest obstacle to the success of group farming, but this is being partly overcome by the collection of payment in kind. This problem arises largely from the belief of some members that the Scheme would carry on even if full payments were not immediately forthcoming. To overcome this it has been decided that no further work will be done in a member's land unless he has paid in full for the coming year in cases where societies have been in operation for two seasons. This is in line with the policy which has been reported for mechanized farming in Pilot Project.

The chances of success and survival of groups vary greatly. The present position can for comparison most conveniently be presented in tabular form (see table on next page).

A. H. Gibson,

Agricultural and Livestock Officer in Charge, Mechanized Group Farming.

SECTION III

SOIL AND CROP RESEARCH

1. GENERAL

DESCRIPTION

This report covers the fourth season of field experiment work in Basutoland in the Colonial Development and Welfare Fund assisted research scheme (Scheme R. 758).

Of the few natural resources of their country the Basuto people are presently dependent on one – the soil. Dense population in the main

Mechanized group farming, 1956 working

Name of Group	Acres worked 1955–56	Acres worked 1956–57	Deposits in Bank as at 1st Oct. 1956	Crops planted 1956–57 Season	Crops planted 1955–56 Season	Average Yield per acre in 200 lb: bags 1956	Remarks
			£ s. d.				
Manganeng . .	151	121	436 11 6	Maize Sorghum Beans	Maize Sorghum Beans	Maize 7·67 Sorghum 5·15 Beans 4·34	Ineffective committee and a complete lack of understanding of co-operation. Through non-payment a number of lands were dropped out of the group, and the rest planted late resulting in a poor start for the new season.
Lovely-Rock . .	219	121	280 10 3	Maize and Beans mixed. Sorghum Beans	Maize and Beans inter-planted	Maize 6·82 Sorghum No record. Beans No record.	An inactive committee, not co-operating and leaving all work to their secretary. This group was nearly closed down through non-payment. Crops promising this season, but only small acreage of Beans and Sorghum planted.
Corn Exchange . Mpho-ea-sechaba	166	162	502 5 9	Maize Sorghum Beans	Maize Sorghum Beans	Maize 6·77 Sorghum No record Beans no rcd	Members still taking a keen interest in group affairs, but yields are still low due to poor soils and water logging in some areas. The society marketed maize co-operatively.
Peka . . . . (Manka)	144	133	421 18 3	Maize and Beans mixed. Beans	Maize and Beans inter-planted	Maize 6·00 Beans No record Sorghum No record	A very keen and intelligent membership, all co-operating well. A large consignment of Beans was marketed co-operatively, which went a long way to paying off members' debts. No crop rotation adopted yet.
Maqeles (Tsoha Mosotho)	159	185	254 2 1	Maize Sorghum Beans	Maize and Beans inter-planted	Maize 6·82 Beans No record	Hard working committee but poor leadership. This group is fast developing a crop rotation plan, and is making efforts to sell crops co-operatively.
Makoanyanes . . (Lifefo)	155	109	319 12 1	Maize Sorghum Beans	Maize and Beans inter-planted	Maize 6·68 Beans No record Sorghum 3·50	A good committee lead by a vice-chairman, the chairman having failed to qualify for having his lands worked this season due to non-payment of charges. It is doubted if this group will survive as a fully tractor operated group due to poorness of soil. So far this year's crop looks poor.
Tsikoane . . .	157	177	332 11 0	Maze Sorghum Beans	Maize and Beans inter-planted	Maize 13·93 Beans Total failure	An inactive committee leaving all tractor operations to the tractor driver, but a large portion of last year's maize crop was co-operatively marketed. If poor crops are reaped this season it will only be due to late weed control, and non-treatment for stalkborer.

farming areas and scarcity of arable land, unenlightened farming methods and an obsolete system of land tenure, lack of natural fuel supplies, an average annual rainfall of less than 30 inches and large areas of soil prone to erosion have all contributed to the exhaustion of this one utilized resource. The crop yields obtained to-day are poor and the territory too often has an unfavourable food supply balance sheet.

In brief, the scheme in Basutoland consists of a programme of field investigations into problems of soil infertility and rehabilitation, planned as a logical follow-on project to the successful anti-erosion campaign. It also includes a search for optimum varieties in relation to ecological regions.

The work is carried out on a central Experiment Station at Maseru and on a set of 10 small sub-stations, or District Experiment Plots, so sited as to be representative of the three pedo-ecological zones and to give good geographical coverage. Supplementary experiments are carried out co-operatively on farmers' holdings.

Operation of the stations is centralized, with planting, treating, harvesting, etc. carried out by the peripatetic main station staff. A mobile self-contained mechanical unit is used for ploughing, cultivating and produce transportation on eight stations. On the two inaccessible by road animal draught is used.

CLIMATIC CONDITIONS

See Table 1 (p. 35).

Rainfall during the year well exceeded the annual means for most stations.

Very heavy rains in November dislocated operations and damaged sorghum and early bean crops, which were also hit by a late frost on the night of November 5th, 1955. A second period of unusually heavy rain occurred in March, causing much lodging.

Climatically the season was thus unusual, but on the whole satisfactory.

THE EXPERIMENTS

New capital development on the main station (C. D. and W. Scheme 1845–A) dominated activities during the year and the experiment programme was reduced slightly compared with that of the 1954–55 season. Amongst others, a 6500 sq. ft. building specially designed for the indoor work connected with field experiments was erected, meeting a long needed requirement in this respect.

Station experiments numbered 59, covering 2700 plots and micro-plots while 31 small experiments (372 plots) were laid out on Basuto farms.

2. SOIL FERTILITY STUDIES

(1) THE NPK EXPLORATORY SERIES

The survey of soil major nutrient status was continued on the District Experiment Plots, where 29 experiments were repeated for the third season.

TABLE I

Rainfall at Maseru Experiment Station and District Sub-Stations 1955–56

(Inches)

Station	1955												1956						Total A	Total B	Total 1955
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June			
LOWLANDS																					
Leribe . .	5·98	7·24	3·65	3·01	1·78	0·34	0·03	0·20	0·04	0·20	4·59	6·04	3·93	4·42	4·87	1·12	2·36	3·08	28·92	25·41	34·90
Berea . .	21·26	6·31	2·42	2·24	1·98	0·73	0·65	0·59	–	2·35	3·46	0·77	2·90	6·09	5·04	1·18	1·01	0·20	21·50	22·38	33·76
Maseru .	9·63	6·97	3·32	2·98	1·20	0·58	0·53	0·04	0·01	2·65	2·50	6·81	1·47	7·25	3·95	0·63	1·09	0·08	27·59	25·31	37·22
Matsieng .	8·91	7·42	2·89	1·97	0·73	0·33	0·40	0·12	0·27	1·75	3·14	4·41	1·64	7·64	6·20	1·89	1·45	0·10	23·43	28·06	31·62
Mafeteng .	6·45	5·48	2·21	2·84	0·98	0·38	–	0·49	–	0·53	0·97	1·40	2·23	2·14	5·00	7·45	0·68	–	15·28	20·21	21·73
Mohale's Hoek	8·38	8·96	2·33	3·76	0·98	0·59	0·48	0·07	0·08	3·24	4·40	3·95	1·07	8·27	6·52	2·53	1·34	0·49	26·84	30·13	37·22
Fort Hartley	7·61	4·58	1·17	2·46	3·67	1·22	–	–	–	1·01	4·72	4·36	3·54	1·75	2·88	3·30	1·20	0·50	23·19	23·26	30·80
FOOTHILLS																					
Qalo . .	6·03	7·78	2·16	2·43	2·47	0·25	–	0·20	0·22	0·64	4·78	6·27	2·39	4·13	3·85	2·50	2·09	–	27·20	24·98	33·23
Machache .	13·79	7·48	5·15	2·29	1·89	0·78	–	–	–	3·43	5·38	7·01	1·59	6·07	6·25	2·95	1·00	0·30	33·41	32·68	47·20
Malealea	4·93	13·77	3·20	1·00	2·16	0·40	–	–	–	0·55	2·87	7·98	2·60	8·20	5·10	2·00	1·63	–	31·93	29·30	36·86
MOUNTAINS																					
Mokhotlong	3·45	4·38	1·27	2·03	0·65	0·33	0·20	–	0·27	1·68	3·27	3·77	3·10	2·26	3·06	0·64	0·82	–	17·85	18·05	21·30

Period effective rainfall Lowland wheat (Total A)

Period effective rainfall Foothill and Mountain wheat, all maize, sorghum etc. (Total B)

Treatments: Factorial combinations of three rates of nitrogen (N0, N1, N2), three rates of phosphate (P0, P1 and P2) and three rates of potash (K0, K1 and K2), where :

N0 = No nitrogenous fertilizer.
N1 = 20 lb. N per acre as Sulphate of Ammonia.
N2 = 40 lb. N per acre as Sulphate of Ammonia.

P0 = No phosphatic fertilizer.
P1 = 25 lb. P_2O_5 per acre.
P2 = 50 lb. P_2O_5 per acre.
} As 1 : 1 mixture Raw Rock and Supers for soils of pH below 6·0 : as Supers for soils of pH above 6·0.

K0 = No potassic fertilizer.
K1 = 15 lb. K_2O per acre as Muriate of Potash.
K2 = 30 lb. K_2O per acre as Muriate of Potash.

Time and method of application: P and K for row crops was drilled 2 to 3 inches below the seed, while N was applied 6 weeks after planting, placed in a band 3 inches from the row on the uphill side. On wheat experiments P and K were broadcast and disced in deeply before planting while the N was spread at the stooling-before-piping stage.

Plot Sizes – Maize: Gross 62′×21′; Nett : 58′×15′ *Wheat and Sorghum:* Gross 60′×15′; Nett : 54′×9′.

Spacing – Maize: 2 feet apart in 3 foot rows. Three seedlings thinned to one per hill. *Sorghum:* 9 inches apart in 3 foot rows. Five seedlings thinned to one per mark. *Wheat:* broadcast at 40 lb. per acre in the lowlands and 90 lb. per acre in the high country.

Varieties – Maize: American White Flint in the lowlands. SA 200 or Cincinatti Bushman in the foothills and mountains. *Sorghum:* Tennant White. Trials that failed to germinate replanted to Texas Martin. *Wheat:* Scheepers and White Spitzkop in the lowlands ; Talberg in the foothills and mountains.

Soil Types – Lowlands: Various sandy loams (pH values 5·2–6·0) and an alluvial clay, pH 6·2. *Foothills:* Ferruginous red loams, pH 5·3–5·8. *Mountains:* Mountain Black clays; pH± 6·6.

Cultivation – Row Crops: 2 hand and 2 implement cultivations.

Wheat: None.

Insecticides and Fungicides: All seed treated with mercurial dust. All maize and sorghum twice dusted with DDT powder.

RESULTS

See Tables 2, 3 and 4 (pp. 37, 38 and 39).

Discussion (NPK Series)

Wheat yields were high, those of maize and sorghum not so good. Coefficients of variation on the whole were satisfactory. Four trials were destroyed by hail.

Lowlands: Large, significant, positive linear and negative curvature responses to phosphate were once again obtained in all crops on most sites in the lowlands. That both main lowland soil types – the grey-brown sandy loams derived from sedimentary formations and the red

TABLE 2 (M.E. Series)

Maize grain in 200 lb. bags per acre

Station	Mean Yield	Coef. of Var.%	Mean yield: plots without N	P	K	Linear Responses N	P	K	SE±	Curvatures N	P	K	SE±	Linear Interactions N'P'	N'K'	P'K'	SE±
LOWLANDS						**	**				**			**			
Leribe	6·67	8·57	4·84	2·36	6·69	+3·59	+6·47	+0·05	0·27	—0·21	—6·43	+0·33	0·47	+2·68	—0·72	+0·69	0·33
							**				**						
Berea	3·76	21·07	3·53	1·70	3·86	+0·25	+3·15	+0·04	0·37	—0·59	—2·86	+0·75	0·65	+0·84	—0·13	+0·42	0·46
						*	**				**	*		**			
Matsieng	8·33	8·96	7·71	4·83	8·59	+1·01	+5·37	—0·01	0·35	—0·65	—4·87	+1·58	0·61	+1·37	—0·31	+0·22	0·43
											**						
Mafeteng	5·16	13·74	4·86	4·52	4·87	+0·57	+0·40	+0·45	0·33	—0·05	—2·62	—0·37	0·58	+0·41	+0·14	—0·15	0·41
							*	**		*		**				**	
Fort Hartley	6·42	12·52	6·84	5·80	5·25	—0·27	+0·97	+1·56	0·38	+1·73	—0·79	—2·36	0·66	—0·13	—0·74	+1·09	0·46
FOOTHILLS																	
							**				**			*			
Qalo	10·50	14·29	10·62	5·93	10·42	+0·23	+7·79	+0·60	0·71	+1·47	—4·03	+1·38	1·22	+1·93	—1·47	+0·09	0·87
							**				**						
Machache	7·71	14·71	7·88	3·08	7·89	—0·36	+7·63	—0·22	0·53	—0·04	—4·92	+0·22	0·93	+0·03	—0·41	+0·85	0·66
						**	**				**						
Malealea	5·83	15·85	6·67	2·90	5·35	+1·85	+4·79	+0·74	0·44	—0·57	—3·24	—0·64	0·75	—0·65	—0·69	+0·11	0·53
MOUNTAINS																	
Mokhotlong	5·22		5·43	4·92	5·34	—0·43	+0·21	—0·16		—0·06	—1·15	+0·22		+0·54	+0·19	—0·06	

* Significant at level P = 0·05
** Significant at level P = 0·01

TABLE 3 (S.E. Series)

Sorghum grain in 200 lb. bags per acre

Station	Mean Yield	Coef. of Var. %	Mean yield, plots without			Linear Responses				Curvatures				Linear Interactions				
			N	P	K	N	P	K	S E ±	N	P	K	SE ±	N P	N K	P K	SE ±
LOWLANDS																		
Leribe	3·64	15 7	3 04	0·79	3·55	+ 1 26 **	+ 4·61 **	—0·05	0·27	+ 0·20	—3 24 **	—0·67 *	0 47	+ 0·94 *	—0·26	—0 15	0 33
Berea	5·21	10·9	4·96	1·89	5·07	+ 0·47	+ 5·72 **	—0·05	0·27	—0 11	—2 78 **	—1 04 *	0·46	+ 0 83 *	—0 13	+ 0·62	0·33
Matsieng						Destroyed by hail												
Mafeteng						Destroyed by hail												
Mohale's Hoek	7·46	13 46	7·44	6 92	7·82	— 0 12	+ 0 58	—0 40	0 47	—0 51	—2 12 *	+ 0 96	0·82	+ 0·66	—0·94	+ 0 20	0·58
Fort Hartley	3·70	35 19	4·22	5·20	4·64	+ 0 15	—1·24	—0 42	0 72	—0 45	+ 1·29	+ 0·36	1·26	—0·67	+ 0·30	—1 12	0·89
FOOTHILLS																		
Qalo	5·70	11·1	5·48	2·04	6·07	+ 0·33	+ 6·48 **	—0 50	0·30	—0 34	—2·53 **	+ 0·72	0 52	+ 0·29	+ 0 43	—0·53	0·37
Machache	1·97	21 2	2·37	0·41	1·73	—0 73 **	+ 2·86 **	+ 0·41	0·20	+ 0·22	—0·80 *	—0·22	0·34	+ 0·94 *	—0 06	+ 0 13	0·24
Maiealea						Destroyed by hail												

* Significant at level P = 0·05
** Significant at level P = 0·01

TABLE 4 (W.E. Series)

Wheat grian in 200 lb. bags per acre

Station	Mean Yield	Coef. of Var.%	Mean yield: plots without N	P	K	Linear Responses N	P	K	SE ±	Curvatures N	P	K	SE ±	Linear Interactions N'P'	N'K'	P'K'	SE ±
LOWLANDS																	
Leribe	5·22	13·16	5·30	2·86	5·04	—0·21	2·81**	0·04	0·22	—0·17	—5·77**	—0·96*	0·39	0·17	—0·43	0·23	0·27
Berea	2·92	24·83	2·94	2·13	2·96	—0·08	1·84**	—0·14	0·34	—0·12	0·77	—0·19	0·59	0·81	—0·12	—0·07	0·42
Matsieng	7·39	17·59	7·40	3·55	7·34	—0·03	6·51**	0·10	0·61	—0·03	—3·54**	—0·03	1·06	0·60	0·38	0·06	0·75
Mafeteng	3·08	22·34	3·04	2·92	3·50	0·10	0·42	—0·56	0·32	0·04	0·28	0·82	0·56	—0·60	0·57	—0·13	0·40
Mohale's Hoek	Destroyed by hail																
Fort Hartley	5·76	12·70	5·35	5·41	5·55	0·71*	0·65	0·71*	0·34	—0·36	—0·15	0·83	0·60	—0·10	0·33	—0·07	0·42
FOOTHILLS																	
Qalo †	4·38	13·34	4·18	2·61	4·18	0·30	2·91**	0·54	0·28	—0·30	—1·92*	0·39	0·49	0·19	—0·33	0·14	0·34
Machache	Crop failure on all plots without P.																
Maleelea	Crop failure on all plots without P.																
MOUNTAINS																	
Mokhotlong	8·77	26·5	8·11	5·37	9·32	1·76	5·33**	—0·60	1·10	1·26	—4·42*	1·49	1·90	0·86	0·44	0·14	1·34

* Significant at level P = 0·05
** Significant at level P = 0·01
† Spring wheat sown following hail damage to original crop.

sandy loams derived from sandstone in conjunction with dolerite – are extremely deficient in phosphate is apparent. Also apparent is that relatively small quantities of phosphate fertilizer bring about large increases in yield and that response curves flatten sharply after the 25 lb. P_2O_5 per acre level.

The response to phosphate (as in previous years) was seldom affected by the absence or presence or rate of nitrogen or potash applied.

Few responses were obtained to nitrogen on the plant populations established, and in the case of maize only on red sandy loam sites. This is possibly accounted for in terms of favourable moisture environments in these deep well drained soils.

Potash had no significant effect on yield except on the lowland alluvial soil.

Foothills: The Foothill Red Loams, derived from basalt and other basic igneus rocks, are extremely deficient in phosphate and responses to P are large for all crops. In the absence of applied phosphate wheat will not grow on these soils and experiments embodying "no phosphate" levels are of little value and usually fail. In future the treatments will be superimposed on a basal phosphate dressing. The possibility exists that it is the calcium fraction of phosphatic fertilizers that is important. This is being investigated. With its higher rainfall, soils of great stability and favourable physical properties, the foothill zone has considerable agricultural potential, the exploitation of which will depend on the solution of the iron-phosphate-calcium relationships of the red soils. Nitrogen and potash fertilizers had no effect on crop yields.

Mountains: The Mountain Black Clays derived from basalt are extremely fertile and it is only on areas of shallow immature soil that responses are obtained to added fertilizers. Increase in crop productivity in the Malutis will depend mainly on improved agricultural methods and better adapted varieties.

Other Fertility Studies

GENERAL

Time and method of treatment applications: Unless otherwise stated, nitrogen, phosphate and potash as for NPK series. Lime and manures applied broadcast in late winter and ploughed in.

Spacing and seeding: Unless otherwise stated, *Maize:* plants 2′ apart in 3′ rows. *Sorghum:* plants 9″ apart in 3′ rows. *Wheat:* broadcast at 40 lb. per acre.

Plot sizes: Unless otherwise stated, *Maize:* 62′×15′ reduced to 58′×9′ for harvesting. *Sorghum and Wheat:* 60′×15′ reduced to 54′×9′ for harvesting.

Varieties – Maize: Mountains and Foothills, and Lowland trials at Maseru, Cincinatti Bushman ; district Lowland trials, American White Flint. *Wheat:* Mountains, Talberg ; Lowlands, White Spitzkop.

Cultivations: Normally two hand and two implement cultivations for row crops.

Insecticides and Fungicides: All seed treated for smut with mercurial dust. All maize and sorghum sprayed with Dieldrin against cutworm and beetle and twice dusted with DDT against stalk borer.

(2) NITROGEN ON MAIZE (EX. M.N.)

The study of the relationship between plant stand density, rate of application of nitrogen fertilizer and time of application was continued at Maseru. Few responses to nitrogen applications on maize, at the normal plant espacements used, have been recorded on rain grown maize in southern Africa.

Treatments: Plant espacements, rates of sulphate of ammonia and times of fertilizer application, where :

S1 = Plants 6″ apart in 3′ rows.
S2 = Plants 12″ apart in 3′ rows.
S3 = Plants 18″ apart in 3′ rows.
S4 = Plants 24″ apart in 3′ rows.
N1 = 20 lb. N per acre as sulphate of ammonia.
N2 = 40 lb. N per acre as sulphate of ammonia.
N3 = 60 lb. N per acre as sulphate of ammonia.
T1 = Half at planting, half at first flowering.
T2 = All at 6 weeks after planting.
T3 = Half at 6 weeks, half at first flowering.

(Sulphate of ammonia placed in band 3″ from plants on uphill side for all times of application).

Basal: 200 lb. superphosphate per acre.

Plot sizes – Gross: 108′×36′ : 36′×36′ and 12′×36′ *Nett:* 66′×34′ (S1), 6′×32′ (S2), 6′×33′ (S3) 6′×32′ (S4).

Soil Type: Red sandy loam on dolerite.

RESULTS

TABLE 5 (Ex. M.N.)

Maize grain in 200 lb. bags per acre

	N1	*N2*	*N3*	*Mean*
S1	4·78	5·71	7·25	5·91
S2	5·32	6·24	7·0	6·18
S3	5·79	6·01	7·02	6·28
S4	4·14	4·81	4·46	4·47
Mean	5·01	5·69	6·43	

	T1	T2	T3
S1	4·31	6·76	6·67
S2	4·60	6·88	7·07
S3	5·60	6·75	6·48
S4	3·05	5·67	4·86
N1	3·60	5·82	5·59
N2	4·50	6·52	6·06
N3	5·07	7·20	7·04
Mean	4·39	6·51	6·23

S.E. diff. two N means = ± 0·20
S.E. diff. two S means = ± 0·47
S.E. diff. two T means = ± 0·38

S.E. diff. two rates N within one S = ± 0·41
S.E. diff. two Spacings within one rate of N = ± 0·41
S.E. diff. two Spacings within one time = ± 0·77
S.E. diff. two rates N within one time = ± 0·40
S.E. diff. two times within one rate of N = ± 0·47
S.E. diff. two cell figures with diff. spacings and diff. N levels = ± 0·41
S.E. diff. two cell figures with diff. times and diff. N levels = ± 0·47

Discussion (Ex. M.N.)

The spacing, time of application and rates of nitrogen effects are significant : thus S1, S2 and S3>S4, T2 and T3> T1, N3> N2> N1.

Of the two factor interactions the general spacing X nitrogen interaction attains significance. It is only where plants were 18″ apart in the row or closer that a response to N was obtained, and the largest response (N3–N1) and the highest yield occurred where sulphate of ammonia was applied to plants 6″ apart in the row, i.e. on a population of 29,000 plants per acre.

The level of yields was very low and no adjustment has been made for losses caused by Black Beetle attack, the effects of which were disproportionately large on plots with the widest spacing (S4).

The question of relative harvesting and threshing costs of "S1 N3" and "S4 N0" type crops must be important.

(3) PHOSPHATE FOR MAIZE (EX. M.P1)

On the Experiment Station at Maseru the trial with various forms and rates of phosphate fertilizer was continued on an area of typical grey-brown sandy loam.

Arrangement: Randomised blocks, with 7 blocks of 10 plots each.

Treatments: Forms and rates of phosphatic fertilizer, where :

S1 = 100 lb. superphosphate per acre.
S2 = 200 lb. superphosphate per acre.
SR1 = 100 lb. 1 : 1 mixture per acre.
SR2 = 200 lb. 1 : 1 mixture per acre.
R1 = 100 lb. raw Moroccan rock per acre.
R2 = 200 lb. raw Moroccan rock per acre.
L1 = 300 lb. Langfos per acre.
L2 = 600 lb. Langfos per acre.
B1 = 100 lb. Basic slag per acre.
B2 = 200 lb. Basic slag per acre.

The B1 and B2 treatments were introduced for the first time (on double control plots) for the 1955–56 crop, and are thus being compared with "third year continuous" treatments. It was considered that the "no phosphate" control was becoming meaningless in that hardly any grain is obtained in the continued absence of phosphate dressings. The S1 treatment will hereafter be considered as control.

Discussion

R2 significantly outyielded the control (S1) and B1, SR1 and S2. The increasing effectiveness of the rock types with time and successive application is apparent. (See over)

RESULTS

TABLE 6 (Ex. M.P. I)

Maize grain in 200 lb. bags per acre

Treatment	1954	1955	1956
	Mean yield	Mean yield	Mean yield
R2	5·34	6·90	8·37
R1	4·31	7·09	7·91
L1	3·78	6·20	7·85
B2	–	–	7·84
L2	3·93	6·59	7·50
SR2	5·69	6·40	7·39
S2	5·81	6·78	7·32
SR1	4·82	6·30	7·27
S1	5·70	6·08	7·22
B1	–	–	6·57
Mean	4·61	6·26	7·52
S.E. Mean yields ±	0·50	0·36	0·264
L.S.D. (5%)	1·44	1·02	0·75
Var. Ratio	5·9	6·4	3·49
F. rqmnt.	2·1	2·1	2·1

(4) POTASH ON A MOUNTAIN BLACK CLAY

The trial under wheat comparing various rates of muriate of potash on a mountain black clay at Mokhotlong was repeated.

Treatments:

K0 = No KCL.
K1 = 10 lb. K_2O per acre as KCL.
K2 = 20 lb. K_2O per acre as KCL.
K3 = 30 lb. K_2O per acre as KCL.
K4 = 40 lb. K_2O per acre as KCL.

Basal: 200 lb. superphosphate per acre.

RESULTS

There were no significant differences between treatments, the yields of all of which were high. (Mean 11·0 bags per acre.)

FERTILITY EXPERIMENTS INCLUDING LIME TREATMENTS

(5) M.D.P.L. SERIES

Two experiments in a fundamental study on maize were repeated on two different soil types to :

(a) Compare the effectiveness, on a total P_2O_5 basis, of kraal manure and a phosphatic fertilizer.

(b) Examine the effect of lime on two very different important soil types.

(c) Investigate the possibility that increased efficiency in phosphate utilization would be brought about by liming.

One experiment was planted at the main sub-station at Machache in the Foothills (8 M.D.P.L.), and one at Maseru (Ex. M.D.P.L.).

Arrangement: 2 replicate, 3 cubed factorial designs in 6 blocks of 9 plots each.

Treatments: Factorial combinations of three rates of total P_2O_5 applied as kraal manure (D0, D1 and D2), three (the same) rates of total P_2O_5 applied as 1 : 1 super-raw rock phosphate fertilizer (P0, P1 and P2) and three rates of high carbonate agricultural lime (L0, L1 and L2), where :

D0 = No kraal manure.
D1 = Kraal manure in quantity to give 25 lb. P_2O_5 per acre.
D2 = Kraal manure in quantity to give 50 lb. P_2O_5 per acre.
P0 = No phosphate fertilizer.
P1 = 25 lb. P_2O_5 per acre as 1 : 1 mixture.
P2 = 50 lb. P_2O_5 per acre as 1 : 1 mixture.
L0 = No agricultural lime per acre.
L1 = 3,000 lb. agricultural lime par acre.
L2 = 6,000 lb. agricultural lime per acre.

Soil Types: At Maseru : Residual grey-brown (sol odised solonetzic) sandy loam derived from sandstone, pH 5·5. At Machache : Residual lateritic red soil derived from basalt, pH 5·4.

RESULTS

See Tables 7(a) and 7(b).

TABLE 7

Maize grain in 200 lb. bags per acre

(a) Acid grey brown sandy loam, pH 5·5 (Ex. M.DPL.)

		P *applied as fertilizer*			L *Lime*			*Mean*
		P0	P1	P2	L0	L1	L2	
P applied as manure (D)	D0	9·41	8·65	8·08	7·98	9·39	8·75	8·71
	D1	9·74	9·53	10·53	10·78	9·61	9·41	9·93
	D2	10·39	11·16	10·20	11·37	10·34	10·12	10·61
	Mean	9·85	9·78	9·64	10·04	9·78	9·43	

P *as erftilizer*	L *Lime*			
	L0	L1	L2	
P0	9·54	10·32	9·68	General mean 9·78
P1	10·11	9·63	9·60	
P2	10·50	9·40	9·02	

Standard errors of means = ± 0·310
Standard errors of cell figures = ± 0·537

(b) Foothill red loam, pH 5·4 (8. M.DPL)

		P *applied as fertilizer*			L *Lime*			*Mean*
		P0	P1	P2	L0	L1	L2	
P applied as manure (D)	D0	6·35	9·64	11·01	8·10	9·31	10·59	9·0
	D1	8·05	9·84	11·02	7·27	10·67	10·97	9·63
	D2	10·45	11·21	11·37	10·28	10·56	12·18	11·01
	Mean	8·28	10·23	11·13	8·22	10·18	11·25	

P *as fertilizer*	L *Lime*			General mean = 9·88
	L0	L1	L2	
P0	5·15	7·92	11·78	
P1	8·31	10·77	11·60	
P2	11·19	11·84	10·37	

Standard error means = 0·244
Standard error cell figures = 0·423

Discussion (M.DPL. experiments)

The maize on both soils responded to manure (third successive application) to the extent of 2 bags per acre.

No response to phosphate was obtained at Maseru (for the first time) while on the Foothill Red Loam the response was large (nearly 5 bags per acre) but disappeared in the presence of manure and/or lime.

Lime produced a slight depression of yield on the grey-brown sandy loam but at Machache the lime response was bigger than either of those to manure or phosphate fertilizer. Here the lime response was little affected by the presence of manure, but disappeared in the presence of phosphate. This is interesting, and gives rise to the question of whether or not it is calcium that is the prime deficiency in this soil.

An attempt will now be made to divorce P and Ca effects by using a concentrated phosphatic fertilizer. This is one of many problems arising out of the mass of data accumulated from the field experiments during the last three years, the elucidation of which will lie mainly in the laboratory.

The presumed iron deficiency induced by the liming in the 1955 crop on the grey-brown sandy loam was not apparent in 1956. Below are some data on pH changes at the end of the third season.

TABLE 8

Soil pH and treatments (M.DPL expts)

Treatment	*Foothill red loam*	*Lowland grey-brown sandy loam*
d0 p0 l0	5·4	5·5
d0 p0 l1	6·0	6·2
d0 p0 l2	6·1	6·4
d2 p0 l2	6·1	6·3
d0 p2 l2	6·3	6·4
d2 p2 l2	6·2	6·4

(6) M.L. SERIES

Two simple trials with various rates of liming for maize were repeated at Teyateyaneng and Matsieng. As with the previous pair two different soil types were used, in this case the two main types found in the lowlands.

Arrangement: At Matsieng: 5×5 Latin Square. At Teyateyaneng: 4 randomised blocks of 5 plots each.

Treatments: Rate of Agricultural Lime where:

L0 = No Agricultural Lime
L1 = 1,000 lb. lime per acre
L2 = 2,000 lb. lime per acre
L3 = 3,000 lb. lime per acre
L4 = 4,000 lb. lime per acre

} Applied in 1953.

Basal: Superphosphate at 200 lb. per acre, drilled below seed.

Soil Types: At Teyateyaneng: Residual podsolic grey-brown sandy loam, pH 5·3. At Matsieng: Red doleritic sandy loam, pH 5·5.

RESULTS

See Tables 9(a) and 9(b).

TABLE 9 (2 M.L.)

Maize grain in 200 lb. bags per acre

(a) Acid grey-brown sandy loam, pH. 5·3

Treatment	1954 Results	1955 Results	1956 Results
	Mean Yield	Mean Yield	Mean Yield
L0	11·09	5·76	4·06
L1	12·20	6·52	4·46
L2	12·05	6·46	4·93
L3	10·58	6·92	4·16
L4	10·09	5·83	4·05
Mean	11·20	6·30	4·33
S.E. mean ylds ±	0·69	0·43	0·21
Variance ratio	1·76	1·34	2·62
F. requirement	3·26	3·26	3·26

(b) Red ferruginous sandy loam, pH 5·4

Treatment	1954 Results	1955 Results	1956 Results
	Mean Yield	Mean Yield	Mean Yield
L0	9·55	7·45	3·21
L1	11·42	7·37	3·05
L2	12·06	7·76	3·95
L3	12·72	8·29	4·81
L4	12·90	8·26	4·63
Mean	11·73	7·83	3·93
S.E. Mean yields	0·42	0·47	0·36
Variance ratio	11·19	0·1	5·05
F. requirement	3·26	3·26	3·26

Discussion (M.L. experiments)

No response to liming was measured on the grey-brown sandy loam while a significant response of 1·41 bags per acre occurred on the red sandy loam derived from sandstone and dolerite. This follows the pattern of previous years' results.

The falling level of yields during the last three seasons is apparent. This is credited to two factors : (a) monoculture, and (b) the practice of removing all stover from the experiment sites, (in line with Basuto practice on maize lands) of which more is written on Page 53 (Winter land use).

Data of pH change are recorded in Table 10 below.

TABLE 10

Soil pH three years after liming

Treatment	*Grey-brown sandy loam*	*Red sandy loam*
L0	5·3	5·5
L1	5·9	5·7
L2	6·0	5·8
L3	6·2	6·0
L4	6·3	6·0

MINOR ELEMENT TRIALS

Trials with minor elements were carried out on wheat and maize in the lowlands and on wheat in the mountains.

(7) MINOR ELEMENTS ON MOUNTAIN BLACK CLAY (WHEAT)

Arrangement: 5 randomised blocks of 6 plots each.
Treatments: Dry soil applications of various salts before planting, where :

O = No treatment.
Cu = 10 lb. copper sulphate per acre.
Zn = 5 lb. zinc sulphate per acre.
Mn = 15 lb. manganese sulphate per acre.
B = 5 lb. borax per acre.
Mg = 50 lb. magnesium sulphate per acre.

Basal: 200 lb. superphosphate per acre.
Soil type: Mountain Black Clay.

RESULTS

There were no significant differences between treatments. The mean yield of the experiment was high – 10·12 bags per acre.

(8) MINOR ELEMENTS ON A LOWLAND GREY-BROWN SANDY LOAM (MAIZE)

Arrangement: 6 randomised blocks of 7 plots each.
Treatments: The (same) five salts were sprayed on maize as 1 per cent solutions on three occasions during the growing season, at 4 weeks,

8 weeks and 12 weeks after planting. The dressings amounted to ± 9·2 lb. of salt per acre.

Basal: 200 lb. superphosphate per acre.

Soil Type: Grey-brown sandy loam (solodised solonetz).

RESULTS

There were no significant differences between treatments. The copper sulphate spraying at 8 weeks caused severe burning.

(9) RESIDUAL MINOR ELEMENT EFFECTS ON WHEAT ON A LOWLAND GREY-BROWN SANDY LOAM

RESULTS

There were no residual responses to copper, zinc, magnesium, manganese (applied as sulphates) and boron (applied as borax).

MANURE AND FERTILIZER

(10) MANURE, FERTILIZER AND MANURE ASH ON THE GREY-BROWN SANDY LOAM (Ex. M.DPA)

A new trial was laid down at Maseru to compare the direct and residual effects of kraal manure, manure ash and phosphatic fertilizer. Considerable quantities of manure ash lie accumulating outside most dwellings in Basutoland, representing wasted fertility. The department is encouraging farmers to use ash on their lands but is encountering two difficulties in this respect : (a) the shortage of carts, and (b) the fact that the ash heaps are traditionally the burial ground for still-born babies. There is an understandable reluctance on the part of many farmers to disturb the mounds.

Arrangement: 5 randomised blocks of 10 plots each.

Treatments: Rates of manure, manure ash and phosphate fertilizer, where :

O = No treatment.
D = Kraal manure.
P = 1 : 1 mixture of Raw Moroccan Rock and supers.
A = Manure ash.
1 = At a rate to give 25 lb. P_2O_5 per acre.
2 = At a rate to give 50 lb. P_2O_5 per acre.
3 = At a rate to give 75 lb. P_2O_5 per acre.

P. Analyses:

Manure O·92 per cent P_2O_5, Ash 1·97 per cent P_2O_5, 1 : 1 mixture 26 per cent P_2O_5.

The D1 dressing amounted to 4264 lb. of manure per acre (36 per cent moisture), the P1 dressing 96 lb. of mixture per acre and the A1 dressing to 1528 lb. of ash per acre (17 per cent moisture).

Basal: First year residual superphosphate at 200 lb. per acre.

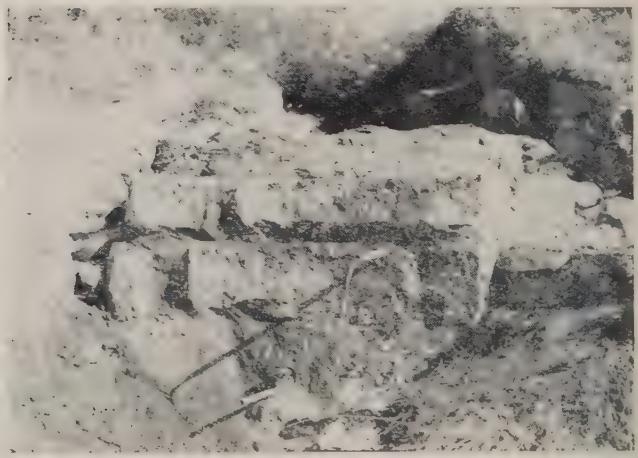
RESULTS

See Table 11.

A dam construction unit in action.

Reclaimed grassland in the mountain area.

The type of self help work in combatting soil erosion which is being actively encouraged.



An improved village water supply within the Pilot Project.

TABLE 11 (Ex. M.DPA)

Maize grain in 200 lb. bags per acre

Treatment	Mean Yield
0	9·14
A1	10·39
D1	10·62
P1	11·07
D2	11·47
A3	11·51
P3	11·89
A2	11·90
D3	12·01
P2	12·45
Mean	11.25
S.E. mean yields	± 0·59
L.S.D. (5%)	1·69
Variance ratio	2·76
F. requirement	2·15

Mean Yield for ash 11·27

Mean Yield for manure 11·37

Mean Yield for phosphate fertilizer 11·80

Discussion

Treatment effects were masked by the residual effects of basal superphosphate. All treatments except A1 and D1 significantly out yield the control. The experiment will be continued to measure residual effects of treatments.

(11) MANURE AND FERTILIZERS ON MOUNTAIN BLACK CLAY

A small trial on maize was repeated at Mokhotlong to compare the effects of manure and fertilizer. It is the only mountain experiment including manure as a treatment.

Arrangement: Randomised blocks.

Soil Type: Mountain Black Clay, pH 6·8.

Treatments: O, D, F, and DF where :

O = No treatment.

D = 50 lb. P_2O_5 per acre as manure.

F = Complete fertilizer (40 lb. N, 50 lb. P_2O_5 and 30 lb. K_2O per acre).

DF = Manure and complete fertilizer.

RESULTS

There were no significant differences between treatments. Of interest is the relatively high mean yield obtained from the S.A. 200 double hybrid used on the trial, – 9·1 bags per acre. Because of low temperatures maize yields of this order are seldom obtained in the mountains.

RESIDUAL EFFECTS

(12) FIRST AND SECOND YEAR RESIDUALS

The NPK and DPL series experiments do not measure residual effects. Also, there has been no rotation of crops in these trials.

A long term experiment was started in 1953 to provide information on residual effects. Directly manured maize is followed by an unmanured bean crop to measure first year residual effects and the beans in turn by wheat for second year residuals. In the wheat comparison is also made

with direct phosphate. The first year residual effects of phosphate is therefore again measured in the subsequent manured maize crop where it is compared with direct nitrogen, phosphate, potash (as fertilizers) and manure.

Arrangement: 2^5 two replicate factorial design in 8 blocks of 8 plots each, repeated on three sites, each site in any one year carrying one phase of a three course rotation of maize, beans, wheat.

Treatments: Factorial combinations of the presence and absence of N, P, K, D and P' where :

Applied to maize only

N = 40 lb. N per acre as Sulphate of Ammonia.
P = 50 lb. P_2O_5 per acre as 1 : 1 Mixture.
K = 30 lb. K_2O per acre as Muriate of Potash.
D = 50 lb. P_2O_5 per acre applied as kraal manure.

Applied to wheat only

P' = 50 lb. P_2O_5 per acre as 1 : 1 Mixture.

Soil Type: Grey-brown sandy loam.

RESULTS

See Tables 12, 13 and 14.

TABLE 12 (Ex. Rot. 1)

Maize grain in 200 lb. bags per acre

(Directly manured)

Direct	Mean Response	Response with direct							
		Nitrogen		Phosphate		Potash		Manure	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
N (Nitrogen)	−3·37	—	—	2·13	4·62	2·96	−3·79	3·50	−3·25
P (Phosphate)	−0·07	−1·32	1·18	—	—	—	—	—	—
K (Potash)	−0·23	—	—	—	—	—	—	—	—
D (Manure)	−0·47	—	—	—	—	—	—	—	—
S.E. ±	0·55	0·77							

General mean = 8·70 Coeff. of variation = 16 per cent.

TABLE 13 (Ex. Rot. 1)

Bean grain in 200 lb. bags per acre

(First year residuals)

First year residual	Mean Response	Response with first year residual							
		Nitrogen		Phosphate		Potash		Manure	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
N (Nitrogen)	−0·04	—	—	—	—	—	—	—	—
P (Phosphate)	−0·25	−0·23	−0·28	—	—	−0·13	−0·38	−0·45	−0·05
K (Potash)	−0·22	—	—	—	—	—	—	—	—
D (Manure)	−0·15	—	—	—	—	—	—	—	—

General mean = 1·70 Coeff. of variation 18·6 per cent

TABLE 14 (Ex. Rot 1)

Wheat grain in 200 lb. bags per acre

(Second year residuals)

Second Year Residuals	Mean Response	Response with second year residual									
		Nitrogen		Phosphate		Potash		Manure		Phosphate	
		Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present
N (Nitrogen)	+0·28	—	—	+0·61	−0·05	+0·32	+0·24	+0·05	0·52	−0·14	+0·71
P (Phosphate)	0·50	+0·83	−0·05	—	—	+0·33	+0·68	+0·60	+0·41	+0·20	+0·31
K (Potash)	−0·47	−0·42	−0·51	−0·64	−0·29	—	—	−0·61	−0·32	−0·02	−0·91
D (Manure)	+0·23	—	+0·46	+0·33	+0·13	+0·09	+0·37	—	—	+0·25	+0·21
P Direct Phosphate	−0·46	−0·88	−0·03	−0·76	−0·15	−0·91	−0·90	−0·44	−0·48	—	—
S.E. ±	0·10				0·14						

General mean 4·15 Coeff. of variation 4·4 per cent.

Discussion

Directly manured maize: The large response to nitrogen (one of the few ever recorded) and the lack of response to manure or phosphate is interesting and unusual, but is perhaps readily accounted for in terms of site history. The old maize land was under a weed fallow in 1953 and 1954, when it was ploughed and levelled. It then lay bare during the 1954–55 season. This may have led to a build up of available phosphate to an adequate level and at the same time, through moisture accumulation, provided conditions favourable to a response to nitrogen.

First year residuals under beans: It is only the residual effect of phosphate fertilizer that is significant, the residual response occurring only in absence of residual manure, the effect of which almost attains significance. The crop suffered from blight and yields were low.

Second year residuals and direct phosphate under wheat: The mean positive responses to second year residual N, P, D, the mean negative response to second year residual potash, and the mean positive response to direct phosphate are statistically significant though small.

That an application of 200 lb. of sulphate of ammonia can produce a second year residual response is of interest.

(13) THIRD YEAR RESIDUALS

An exploratory experiment on wheat laid down in the winter of 1953 has since been repeated annually without further treatment to measure residual effects.

Treatments: (Applied in March 1953.) Factorial combinations of the presence and absence of N.P.K. and D., where N = 20 lb., P = 50 lb. P_2O_5, K = 30 lb. K_2O and D = 4 tons of manure per acre (50 lb. P_2O_5).

Soil Type: Grey-brown sandy loam.

RESULTS

Third year residual effects and interactions did not attain significance.

(14) WEED CONTROL IN MAIZE (Ex. M.WK.)

A modified experiment on methods of weed control in maize was continued at Maseru.

Arrangement: 6 randomised blocks of 9 plots each.

Treatments: Methods of weed control, where :

O = No weed control.
Postspray = Post-emergent spray of 2·4D at 1 pint per acre.
Prespray = pre-emergent spray of 2·4D at 2 pints per acre.
Postspray + 1C = Postspray as above plus one implement cultivation.
2C = Two implement cultivations.
3C = Three implement cultivations.
HC = Clean hand cultivation.
HC + 1C = One hand cultivation plus one implement cultivation.
(Prespray 5 days after planting ; postspray when maize 4″ to 6″ tall. 2 pints amine salt contain 1lb. acid equivalent.)

Basal: 200 lb. superphosphate per acre.

RESULTS

See Table 15.

TABLE 15

Maize grain in 200 lb. bags per acre

Treatment	*Mean Yield*
Postspray + IC	17·52
Prespray + IC	16·08
HC + IC	16·04
3C	14·39
2C	13·57
HC	12·94
Prespray	9·33
Postspray	8·30
0	2·40
Mean	12·06
S.E. Mean yields	±0·675
L.S.D. 5(%)	1·93
Variance ratio	20·54
F. requirement	2·18

Discussion

In a wet early summer such as was experienced in 1955–56 the advantages of spraying against weeds become apparent. During periods of high humidity when soils are sodden normal cultivation methods are not entirely effective.

(15) WINTER LAND USE

A new trial was laid out in 1955 to compare the effects of variations of winter use of arable lands. The winter communal grazing of lands in Basutoland with heavy grazing intensities followed by the removal of all dung for domestic fuel, and often all remnant maize stalks and weeds as well, must have an important bearing on soil fertility. The 1956 crop measured the effects of treatments applied in 1955.

Arrangement: Randomised blocks, with split plots.

Treatments: As follows :

(a) *Main plots*

1. No grazing after harvest.
2. 1500 large stock grazing hours per acre.
3. 1500 large stock grazing hours per acre, with remnant stover removed.
4. 1500 large stock grazing hours per acre, with dropped dung removed.
5. 1500 large stock grazing hours per acre, with dropped dung and remnant stover removed.

(b) *Sub-plots*

E. Ploughed as early as possible.

L. Ploughed after spring rains.

Basal: 150 lb. superphosphate per acre.
Soil type: Poorly drained grey-brown sandy loam.

RESULTS

There were no significant differences between treatments. Effects will no doubt appear only after several years of treatment.

(16) CO-OPERATIVE EXPERIMENTS

Gross definition of the major nutrient status of Basutoland soils has been obtained from the station experiments carried out over the last three years. In order to accumulate data on the economics of fertilizing under ordinary Basuto farming conditions a scheme of co-operative experimentation was started in 1954, when 16 small trials were laid out on farmers' holdings. The scheme was continued during 1955–56 on a larger scale, with improved block lay-out in the experiments.

A short course in field experiment methods was given to 16 selected demonstrators from all the lowland districts. Subsequently each man carried out two small trials in his area, co-operating with local farmers. The farmer, after the experiment was laid out and the fertilizer applied, planted and tended his crop in his normal manner.

Design: 3 randomised blocks of 4 plots each.
Treatments: 4 rates of the 1 : 1 phosphate mixture, where :

P0 = No fertilizer.
P1 = 75 lb. mixture per acre.
P2 = 150 lb. mixture per acre.
P3 = 225 lb. mixture per acre.

Method of application: Fertilizer broadcast in spring and ploughed in.
Plot size: Gross 60′×21′. Nett : 60′×15′.

RESULTS

See Table 16 (p. 55).

Discussion

Because of variability of stands in the field and with the estimates of error based on only 6 degrees of freedom many of the treatment differences did not attain statistical significance. Of the 28 experiments harvested 15 showed up significant positive responses to phosphate.

The magnitude of responses was affected by the fact that the fertilizers were applied broadcast. Drilled phosphate is more effective than broadcast phosphate in the first season of application in Basutoland. Further, several trials were damaged by frost due to farmers planting their crops too late, and yields, and hence responses, were reduced accordingly.

Taking means for the series, profits are nevertheless shown for all three rates of fertilizer application.

Mean responses (28 trials) to 75 lb., 150 lb. and 225 lb. of the 1 : 1 phosphate mixture per acre were 0·91, 1·54 and 1·69 bags of grain per acre respectively. At producers' prices of 25*s.* per bag for maize and 14*s.* per 100 lb. for the fertilizer, mean net profits accruing from these

TABLE 16

Co-operative experiments, 1955–56 Maize grain in 200 lb. bags per acre

Northern Districts

Area	Butha-Buthe				Leribe				Berea				Pilot Project				Mean
	Qholaqhoe	*Phaku*	*Makopo*	*Majara*	*Mahobong*	*Mahobong*	*Pitseng*	*Pitseng*	*Qalaheng*	*Tsereoane*	*T.Y.*	*T.Y.*	*Bale*	*Mohatlane*	*Moqhoane*		
Expt. No.	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	
Soil pH.	5·5	5·3	5·4	5·4	5·3	5·3	5·4	5·3	5·5	5·7	5·7	5·8	5·4	5·6			
Treatment									*Mean Yield*								
P0	4·44	2·02	2·02	2·82	2·96	0·67	0·69	–	3·63	4·03	1·01	3·63	3·50	1·88	4·57	–	2·71
P1	5·11	3·76	5·11	3·76	4·51	1·28	2·10	–	4·84	4·03	2·50	5·24	5·24	2·96	4·44		3·92
P2	5·51	2·90	5·65	4·71	4·84	2·69	2·10	–	7·26	5·24	2·74	5·65	6·32	4·44	5·38		4·75
P3	5·92	4·71	7·66	6·86	4·77	3·50	3·35	–	7·26	4·84	3·55	8·07	6·45	6·05	5·92		4·88
Mean	5·24	3·60	5·11	4·54	4·26	2·03	2·06	–	5·65	4·54	2·46	5·65	5·38	3·83	5·04		4·24
S.E. Mean yields ±	–	0·51	0·45	1·11	–	0·31	0·35	–	0·48	–	0·30	0·70	0·47	0·61		–	
L.S.D. (5%)	–	1·75	1·54	2·72	–	1·06	1·23		1·65	–	1·05	1·97	1·62	2·13	–		
Var. ratio	1	5·0	10·0	5·42	1	17·6	9·63	–	15·29	3·80	12·5	9·67	8·55	8·68	1	–	

Southern Districts

Area	Maseru				Mafeteng				Mohale's Hoek				Quthing				Mean
	Roma	*Maliele*	*Morija*	*Morija*	*Mapotu*	*Mapotu*	*Qaba*	*Qaba*	*Brakfontein*	*Mekaling*	*Taung*	*Taung*	*Qomoqomong*	*Dilli-Dilli*	*Sebapala*	*Sebapala*	
Expt. No.	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	14a	14b	15a	15b	16a	16b	
Soil pH.	5·3	5·6	5·5	5·6	5·6	5·6	5·3	5·6	5·6		5·4		5·7	5·3			
Treatment									*Mean Yield*								
P0	1·75	0·52	4·30		4·44	8·07	0·73	4·92	5·38	3·50	2·42	0·13	5·65	5·59	4·73	–	3·79
P1	3·09	0·48	4·71	–	4·44	8·87	1·61	5·77	4·30	2·42	3·09	0·54	7·53	8·20	6·50	–	4·39
P2	3·09	0·32	5·65	–	3·63	9·28	2·12	6·57	5·65	2·82	3·50	1·34	7·93	8·60	7·26	–	4·83
P3	2·69	0·89	6·99		5·24	9·68	2·70	7·38	3·50	3·63	3·50	1·61	8·47	6·32	7·26		4·99
Mean	2·66	0·56	5·38	–	4·44	8·99	1·81	6·17	4·71	3·09	3·13	0·87	7·40	7·43	6·28		4·56
S.E. Mean yields ±	0·21	–	–	–	0·26	–	–	0·38	0·44	–	–	–	–	0·51	–	–	
L.S.D. (5%)	0·71	–	–	–	0·88	–	–	1·33	1·53	–	–	–	–	1·76	–	–	
Var. ratio	9·44	3·0	2·0	–	8·1	1	3·48	7·7	5·03	1·41	1·04	1	1·27	5·07	4·54	–	

ertilizer applications are 12·25*s*. (P1), 17·5*s*. (P2) and 10·75*s*. (P3) per acre respectively.

In terms of food production, and based on the (low) mean responses of this series, it can be concluded that the general use of phosphate fertilizer on maize lands in the lowlands and foothills at the rate of 150 lb. per acre, could, in the first season of such applications, bring about an increase in maize production of 47 per cent, or, in terms of an annual maize acreage of 375,000, an increase in territorial food supplies of 580,000 bags of grain.

A study of the results of the station NPK series, where even in the absence of crop rotation mean yields are considerably higher, indicates that with better seeds, stands and cultivation, this increase in food supplies due to added fertilizer could exceed a million bags a year.

3. CROP STUDIES

Details of the aims of the work on crop varieties and techniques used were given in the report for 1954.

MOUNTAIN AND FOOTHILLS

(17) WHEAT

The eight best selections from the original 81 local lines were tested in a variety trial at Machache, which will be repeated for several years.

(18) SORGHUM

16 sorghum selections were retained from the 40 planted at Machache (originally 320).

LOWLANDS

(19) MAIZE

16 varieties were compared in an early planted trial on a new levelled site but no significance could be attached to yield differences.

9 short season varieties were tested for December planting. All were caught by frost before maturity.

A trial with 36 entries was carried out for the Bethlehem Research Station of the South African Department of Agriculture.

(20) SORGHUM

The sorghum variety trial failed.

(21) WHEAT

130 lines and varieties of spring sown wheat were planted for observation and rust-resistance scoring.

The annual trial of 25 commercially available varieties was repeated at Maseru.

Arrangement: 5×5 lattice with 4 replications.

Sowing rate: 40 lb. seed per acre broadcast and harrowed in.

Plot size: Gross : 15′×30′ Nett : 13′×28′.

Basal: 200 lb. 1 : 1 phosphate mixture per acre.
Soil Type: Grey-brown sandy loam.
Planted: Early planting 27.4.55. Late planting 30.5.55.
Harvested: Early planting 13.12.55. Late planting 28.12.55.

RESULTS

See Table 17.

TABLE 17. [Ex. W.V. (1) and Ex. W.V. (2)]

Wheat grain in 200 lb. bags per acre

Early Planted		*Late Planted*	
Variety	*Mean Yield*	*Variety*	*Mean Yield*
Queen Fan	4·82	Red Victory	5·85
Red Egyptian	4·55	Red Egyptian	5·49
Scheepers	4·55	Lowland No. 1	5·47
Lowland No. 1	4·48	Queen Fan	5·22
Red Victory	4·18	Maluti	5·03
Maluti	4·11	Mountain No. 1	4·85
Harpers	3·91	Roussouws Baard	4·82
Sterling	3·84	Daeraad	4·80
Red Spitzkop	3·81	Penkop	4·76
Impala	3·75	Harpers	4·74
Penkop	3·73	Red Spitzkop	4·65
Punjab	3·67	White Spitzkop	4·65
Mountain No. 2	3·64	Punjab	4·58
Talberg	3·63	Mountain No. 2	4·55
White Spitzkop	3·55	Vorentoe	4·52
Daeraad	3·55	Scheepers	4·41
Roussouws Baard	3·53	Impala	4·39
Mountain No. 1	3·52	Talberg	4·34
Goudveld	3·45	Goudveld	4·34
Hoopvol	3·42	Sterling	4·18
Sonop	3·34	Hoopvol	4·01
Duiker	2·95	Manitoba	3·74
Vorentoe	2·86	Lalkasarwali	3·63
Lalkasarwali	2·81	Sonop	3·57
Manitoba	2·74	Duiker	3·06
Mean	3·70		4·55
S.E. Mean yields ±	0·07		0·05
L.S.D. 5%	0·24		0·50
Variance ratio	59·68		17·37
F. requirement	1·72		1·72

Discussion

Of interest is the higher yield obtained for all varieties from late planting, the good performance of Red Egyptian, and the relatively poor showing of the Spitzkop varieties. Few conclusions on the merits of varieties can as yet be drawn.

(22) BEANS

16 varieties were compared at Maseru.
Arrangement: 4×4 lattice with 4 replications.

Spacing: Plants 6″ apart in 3′ rows.
Plot size: Gross : 30′×15′. Nett : 28′×9′.
Basal: 200 lb. 1 : 1 phosphate mixture per acre.
Soil type: Grey-brown sandy loam.
Planted: 8.12.55.
Harvested: 10.4.56 to 4.5.56.

RESULTS

See Table 18.

TABLE 18 (Ex. B.V.)

Bean grain in 200 lb. bags per acre

Variety	*Mean Yield*
Small White Haricot	5·95
Pink Wacher	2·98
Khaki Sugar	2·90
Ginger Speckled *	2·78
Cream Wacher *	2·43
Black Wonder	2·27
Tepary	1·97
Black Zebra *	1·84
Red Sugar	1·58
Khaki Round*	1·54
Canary Yellow	1·47
Purple Speckled *	1·34
Van Zyl Sugar	1·32
Canadian Wonder	1·19
Joko	0·56
Victory	0·33
Mean	2·03
S.E. Mean yields ±	0·29
L.S.D. 5 per cent	0·84
Variance ratio	16·84
F. requirement	2·47

* Name given for convenience to local varieties

Discussion

Planted on a typical area of solodised solonetzic grey-brown sandy loam most varieties were adversely affected by water-logged conditions, and a subsequent attack of bacterial wilt. The worth of Small White Haricot and Pink Wacher was again well demonstrated.

(23) CASTOR

An exploratory factorial experiment embodying the presence and absence contrast of NPK and lime and with two spacings was continued at Maseru.

RESULTS

Yield figures are not tabulated. There was a small response to phosphate, while 18″×3′ spacing was better than 3′×3′.

(24) OBSERVATION PLOTS

Non replicated observation plots on a range of sunflower, cowpea, bean, soybean and groundnut varieties were again planted at Maseru. Yields are not presented.

(25) PASTURES

A new pasture nursery was established by the Agricultural Education Officer.

(26) FRUIT

Satisfactory growth was recorded in the small apple variety trial at Machache. Growth at Mokhotlong in the mountains was slow.

4. SUMMARY OF RESULTS AND COMMENTS

The deficiency of phosphate in lowland and foothill soils dominates the soil status picture. Response to added phosphate has been shown to be large in all areas of these zones, and the conclusion is drawn that the general annual use of relatively small quantities of phosphatic fertilizer (or manure or manure ash) by farmers could make the territory more than self sufficient in food production. Under an advance account, and planned on a "pump priming" basis, 100 tons of superphosphate were readily disposed of to farmers during the season. It is hoped that the trade will considerably increase imports of fertilizer. Rock phosphates, after the second successive year of application, are better than super-phosphate for maize.

The lack of response to nitrogen is intriguing. Of the results from the 102 experiments on cereals in which nitrogen was a treatment, carried out during the last three years, only 19 contain significant N responses and of these 6 were negative. Results from the Bethlehem Research Station in the adjoining Orange Free State are similar. Nevertheless, Free State farmers are obtaining satisfaction from fertilizer mixtures containing nitrogen, which are being used on an increasing scale (with the support of the fertilizer companies). While no results are yet available from proper rotation trials it is apparent that cereals following beans or cowpeas outyield continuous cereal.

More research on nitrogenous fertilizers in relation to time and method of application, plant population, phase of rotation etc. is necessary and few conclusions can as yet be drawn on the question of nitrogen manuring of cereals. These questions are being thoroughly investigated in the current season projects.

That liming of acid ferruginous soils is safe and beneficial but that liming of the grey-brown sandy loams in the lowlands can be dangerous and is unlikely to increase maize yields has emerged from results to date. The sandy loams of the lowlands are lightly buffered.

The field experiment technique when used for minor element studies is vulnerable to technological and other difficulties, which may well preclude the discovery of important deficiencies. With this qualification it can be concluded that no minor element deficiencies exist in lowland and mountain soils, in respect of the common crops grown in these regions.

The usefulness and importance of manure and manure ash have been quantitatively assessed, but little information is as yet available on the

effects of manure and plant residues on soil physical properties and long term fertility and stability.

From a study of the level of yields obtained on the lowland experiments it is apparent that phosphate deficiency, while being the main cause of poor crops is but one consideration, and that some other factor (or factors) is depressing yields. Long term research must now be directed towards the effects of grass leys, crop rotations and systems of management, wherein it is likely that soil physical conditions will be found to be important.

No final conclusions on the merits of various crop varieties can as yet be drawn.

Uncertainties that have arisen in relation to responses to nitrogen and lime particularly reveal the necessity to supplement the field work by laboratory analytical studies.

5. PRESENT SEASON PROJECTS (1956–57)

The programme reported on here is being continued with certain modifications.

Having served their purpose, four of the ten district experiment plots have been abandoned, leaving for an indefinite period four in the lowlands and one each in the foothills and mountains.

Certain new projects are included in the present season programme, viz :

(a) Two trials on forms and rates of agricultural lime.

(b) An experiment with minor elements in the foothills.

(c) Four trials on methods of application of nitrogen for maize.

(d) An experiment on tillage methods.

(e) A field pea variety trial.

(f) A comparison of arable rotations.

(g) Under the terms of reference of the Soil Fertility Worker appointment, 9 exploratory experiments on maize have been laid out in various parts of Swaziland.

(h) As a result of a recommendation made by the Southern African Regional Committee for the Conservation and Utilization of the Soil, plans have been drawn up for a scheme of pasture research for the mountain zone of Basutoland.

6. LIAISON WITH OTHER WORKERS, AND ACKNOWLEDGMENTS

Contact has been maintained with various workers in the Union of South Africa, and the advice and assistance of Professors E. R. Orchard and A. A. Rayner and their staff at Natal University is acknowledged with thanks as is assistance by Mr. J. Sellschop of the Potchefstroom Experimental Station.

The excellent service rendered by the Junior Service technical assistants of the research section must be placed on record.

A. C. Venn,
Soil Fertility Officer.

APPENDIX I

MEAN MONTHLY RAINFALL

(Nine stations, at District Headquarters)

			Average for 6 years	*Variation*
1955	September	·14 inches	·81	— ·67
	October	2·25 ,,	2·59	— ·34
	November	3·85 ,,	3·22	+ ·37
	December	5·45 ,,	3·84	+1·61
			Average for 7 years	*Variation*
1956	January	3·59 ,,	4·62	—1·03
	February	6·55 ,,	5·77	+ ·78
	March	4·42 ,,	3·50	+ ·92
	April	2·23 ,,	2·31	+ ·08
	May	1·36 ,,	1·04	+ ·32
	June	·25 ,,	·42	— ·17
	July	·30 ,,	·42	— ·12
	August	·12 ,,	·39	— ·27
	September	·72 ,,	·92	— ·20
	October	2·05 ,,	2·56	— ·51
	November	4·18 ,,	3·28	+ ·90
	December	7·51 ,,	4·18	+3·33
		33·28 ,,	29·41	+3·87

Annual Average for 40 years : 28·95 inches.

APPENDIX II

STAFF

In the list which follows are given dispositions of staff as at 31st December, 1956.

Maseru

P. A. Bowmaker, O.B.E.	Director of Livestock and Agricultural Services.
D. D. Campbell, M.C.	Principal Agricultural Officer.
P. H. Brown	Principal Veterinary Officer.
S. H. Youthed	Soil Conservation Officer.
J. G. S. Bennie	Wool and Mohair Officer.
N. N. Raditapole	Veterinary Officer.

A. C. Venn	Soil Fertility Officer.
J. R. L. Kotsokoane	Agricultural Education Officer.
A. G. Brightmore	Senior Agricultural and Livestock Officer.
V. S. Gilbey	Agricultural and Livestock Officer (Experiment Station).
J. J. Axentowicz	Development Officer.
G. Nchee	Forestry Officer.
R. F. Phillips	Accounting Clerk.
N. W. Dixie	Assistant Accounting Clerk.
Miss H. B. Corney	Senior Lady Clerk.
F. Makhooane	Clerk-Storekeeper.
Mrs. C. E. Carton	Lady Clerk-Typist.
E. T. G. Ntšasa	Assistant Agricultural and Livestock Officer.
E. Lesoli	Assistant Agricultural and Livestock Officer.
N. J. Molapo	Administrative Assistant.
T. Motsamai	Senior Veterinary Assistant.
C. A. Motsamai	Teacher-Boarding Master.
	1 Senior Conservation Foreman.
	2 Soil Conservation Foremen.
	10 Demonstrators.
	3 Veterinary Assistants.
	12 Assistant Demonstrators.
	8 Clerks.

Mafeteng

E. J. V. Wiggill	Agricultural and Livestock Officer.
	1 Soil Conservation Foreman.
	1 Veterinary Assistant.
	3 Demonstrators.
	4 Assistant Demonstrators.
	1 Clerk.

Mohale's Hoek

A. Bisschoff	Agricultural and Livestock Officer.
M. C. Macintosh	Assistant Soil Conservation Officer.
	1 Veterinary Assistant.
	5 Demonstrators.
	6 Assistant Demonstrators.
	1 Clerk.

Quthing

H. B. Wroughton	Agricultural and Livestock Officer.
	1 Veterinary Assistant.
	4 Demonstrators.
	6 Assistant Demonstrators.
	1 Clerk.

Qacha's Nek

P. Millin	Agricultural and Livestock Officer.
	1 Veterinary Assistant.
	7 Demonstrators.
	4 Assistant Demonstrators.
	1 Clerk.

Mokhotlong

C. M. K. Seape	Development Officer (Acting Agricultural and Livestock Officer). 1 Veterinary Assistant. 7 Demonstrators. 5 Assistant Demonstrators. 1 Clerk.

Butha Buthe, Leribe and Berea

I. L. Chard	Senior Agricultural and Livestock Officer.
D. Schneider	Assistant Soil Conservation Officer.

Butha Buthe

A. Mathule	Assistant Agricultural and Livestock Officer (Acting Agricultural and Livestock Officer) 1 Veterinary Assistant. 3 Demonstrators. 4 Assistant Demonstrators. 1 Clerk.

Leribe

S. Letsie, B.E.M.	Development Officer (Acting Agricultural and Livestock Officer). 2 Soil Conservation Foremen. 1 Veterinary Assistant. 6 Demonstrators. 4 Assistant Demonstrators. 1 Clerk.

Berea

D. Lekena, B.E.M.	Development Officer (Acting Agricultural and Livestock Officer). 1 Veterinary Assistant. 1 Soil Conservation Foreman. 3 Demonstrators. 4 Assistant Demonstrators. 1 Clerk.

Pilot Project

A. J. A. Douglas, M.B.E.	Administrative Officer (seconded).
A. L. Mapham	Agricultural Officer (seconded).
A. Wuister	Mechanic -Supervisor
G. Mochochoko	Development Officer (seconded). 1 Soil Conservation Foreman (seconded). 1 Co-operative Organizer. 4 Demonstrators (seconded). 1 Clerk (seconded). 1 Clerk-Recorder.

Mechanized Group Farming

A. H. Gibson	Agricultural and Livestock Officer (seconded)
P. Tšoeu	Assistant Agricultural and Livestock Officer (seconded).

Vacancies on Establishment

1 Agricultural Officer.
1 Senior Agricultural and Livestock Officer.
18 Assistant Demonstrators.

APPENDIX III

IMPORTATION OF MAIZE FROM THE UNION OF SOUTH AFRICA

(Bags of 200 lb. nett)

	1956	*8-year average*
January	25,608	15,073
February	29,815	11,930
March	24,285	10,216
April	12,411	8,489
May	9,961	7,750
June	6,933	5,411
July	1,521	5,343
August	3,895	11,165
September	1,593	11,379
October	4,137	16,951
November	4,581	20,530
December	7,744	19,358
Total	132,484	143,595

APPENDIX IV

FERGUSON TRACTOR OPERATING COSTS

The following tables are based on data from the four Pilot Project tractors and tractor farming groups, from August, 1953, to June, 1956. The estimates of cost are however calculated on commercial landed prices in Basutoland. Rates of fuel consumption per hour, acreage ploughed per hour, etc. are derived from field records. Depreciation has been calculated according to formulae agreed with N.I.A.E.

It will be clear that there is no one figure for cost per hour per acre which is valid under all circumstances. The final cost per hour or per

acre must vary with the number of hours worked in the year, the proportion of work to travel and idling in each day, the shape and sizes of fields ploughed or planted, as well as with standards of driving, maintenance and management. Here it is only possible to show directly the effects of the first two of these factors. The other factors however have helped to determine all the estimates of cost, which, being based on the results of three seasons' work by four groups, inevitably reflect many of the circumstances likely to affect tractor operations in Basutoland.

A. Analysis of costs

Item	*Cost or price*	*Cost, etc. per unit*	*Remarks*
Tractor: Diesel	£740 (See note 1)	Depreciation 3/- p.h. + 1/- = 4/-	
Paraffin	£600 (See note 2)	2/5 + 1/- = 3/5	
Fuel:			
Diesel Diesoline tractor	2s. 3d. per gall (0·8 galls p.h.)	Cost 1/9½	
Paraffin tractor — Paraffin	1s. 10d. per gall (1·2 galls p.h.)	2/-	I Basic cost per hour
Paraffin tractor — Petrol	3s. 4d. per gall (0·05 galls p.h.) (current wholesale landed price)	-/2	
Lubricants	various	–/3	
Mechanic, Repairs and Spares:	(See note 3)		
Diesel tractor		1/3	
Paraffin tractor		1/- p.h.	
Wages:	Secretary £1 p.m. Driver 3s. 6d. p.d. (excluding holidays etc.)	Cost £65 p.a.	II Fixed overheads; i.e. cost per hour or per acre varies with total hours or acreage.
	Cost Dep'n Interest		
Implements:		Dep'n and Interest	
Plough 3 Furrow	£150 15s. 7d.	22	
Plough 2 Furrow	100 10 5	15	
Planter	100 20 5	25	
Trailer	160 10 8 p.a. (See note 4)	18	
Tractor: Diesel	Interest and Insurance £74	74	
Paraffin	Interest and Insurance £60 p.a. (See note 5)	60 p.a.	

p.h = per tractor running hour
p.d = per day
p.m — per month
p.a = per annum

Notes on Table A:

1. Crown Agents landed cost of Diesel tractor : £602.

2. Crown Agents landed cost of Paraffin tractor : £468.

Approx. difference in both cases £134. To depreciation on commercial cost (500 hr. life) is added 1*s.* p.h. covering predictable additions to capital value i.e.
1 battery (£10) every 1,500 hrs.
1 set tyres (£65) every 3,000 hrs.
1 overhaul (£100) every 5,000 hrs.

3. Cost of mechanic, repairs and spares :

Group	*1953–54*	*54–55*	*55–56*	*Total Hours*		*Approx. cost p.h.*
Mesapela	£34	38	213[1]	285	1763	£0·16
Thaba Chitja	32	89	39	160	2169	0·08
Rampepes	29	46	78	153	2199	0·07
Malimong	55	29	130[2]	214	1975	0·11
				812	8106	0·10 = 2*s.*

[1] Major repairs crankshaft etc. £170
[2] Repairs due to accident 50
(fell in donga)

Estimated cost over 5000 hrs :
Diesel 2*s.* 3*d.*, less 1*s.* allocated to additional depreciation — 1*s.* 3*d.*
(See notes 1 and 2.)
Paraffin 2*s.*, less 1*s.* allocated to additional depreciation 1*s.* 0*d.*
(Includes mechanic's time @ 15*s.* per job hour.)

4. Implements: depreciation per annum:
planter: one-fifth commercial cost.
trailer: one-sixteenth commercial cost.
Others: one-tenth commercial cost.
Interest p.a.: all: 5 per cent commercial cost.
Costs p.h. are calculated on above to nearest £5 p.a. in table B.)

5. Tractor : interest p.a. : 5 per cent on commercial cost.
insurance p.a. : 5 per cent on commercial cost.

B. Cost per tractor running hour

(Based on Table A)

I. BASIC

Item	*Diesel tractor*	*Paraffin tractor*
Tractor depreciation	4/-	3/5
Fuel	1/9½	2/2
Lubricants	-/3	-/3
Mechanic, repairs and spares	1/3	1/-
Total	7/3½	6/10 p.h.

II. FIXED OVERHEADS

Item	*Tractor running hours per annum*			
	400	600	800	1000
Diesel tractor:				
Wages £65				
Interest and insurance 74				
say 140	7/-	4/8	3/6	2/10
Plough 3F say 20	1/-	-/8	-/6	-/5
Paraffin tractor:				
Wages 65				
Interest and insurance 60				
125	6/3	4/2	3/2	2/6
Plough 2F 15	-/9	-/6	-/5	-/3½
Planter 25	1/3	-/10	-/7½	-/6
Trailer say 20	1/-	-/8	-/6	-/5 p.h.

III. TOTAL COST PER TRACTOR RUNNING HOUR

(Sum of I and II)

Tractor and operation	*Tractor running hours per annum*			
	400	*600*	*800**	*1000*
Diesel tractor:	14/3½	11/11½	10/9½	10/1½
plus ploughing	1/-	-/8	-/6	-/5
plus planting	1/3	-/10	-/7½	-/6
plus transport	1/-	-/8	-/6	-/5
Paraffin tractor	13/1	11/-	10/-	9/4
plus ploughing	-/9	-/6	-/5	-/3½
plus planting	1/3	-/10	-/7½	-/6
plus transport	1/-	-/8	-/6	-/5 p.h.

(1) As assumed in calculation of cultivation charges for 1956–57 season i.e. ploughing costs:

Diesel: tractor 10/9½ }
plough -/6 } 11/3½ p.h.
Paraffin: tractor 10/- }
plough -/5 } 10/5 p.h.

(2) Transport costs, based on total of 800 tractor hours (including all operations) are estimated as follows:

Diesel: tractor 10/9½ }
trailer -/6 } 11/3½ p.h.
Paraffin: tractor 10/- }
trailer -/6 } 10/6 p.h.

APPENDIX V

Livestock industry statistics

	Cattle	*Horses*	*Mules*	*Donkeys*	*Sheep*	*Goats*
Census (1955)	408,144	102,001	4,829	48,855	1,339,019	654,800
Exports	8,395	63	–	–	4,008	56
Imports	9,360	3,367	48	164	352	–
Wool Exports (lb.)	–	–	–	–	7,292,626	–
Mohair Exports (lb.)	–	–	–	–	–	1,068,082
Bones Exported (lb.)	165,000	–	–	–	–	–
Hides Exported (Units)	25,914	–	–	–	–	–
Skins Exported (Units)	–	–	–	–	117,474 (Sheep and Goats)	